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| International application number:            | <b>PCT/IB2024/057701</b>                        |
| International filing date:                   | <b>08 August 2024 (08.08.2024)</b>              |
| Document type:                               | <b>Certified copy of priority document</b>      |
| Document details:                            | Country/Office: <b>US</b>                       |
|                                              | Number: <b>63/519,012</b>                       |
|                                              | Filing date: <b>11 August 2023 (11.08.2023)</b> |
| Date of receipt at the International Bureau: | <b>08 August 2024 (08.08.2024)</b>              |

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-bis)

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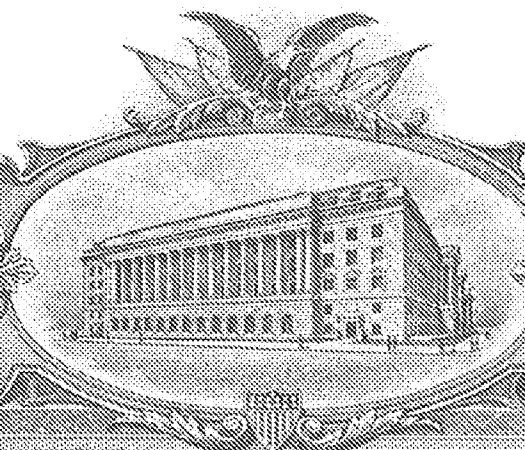
Application number: 63519012

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# THE UNITED STATES OF AMERICA

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*August 08, 2024*

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**APPLICATION NUMBER: 63/519,012**  
**FILING DATE: *August 11, 2023***

**THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS *US63/519,012***



Certified by

*Kathi*

Under Secretary of Commerce  
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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|------------------------|-------------------------|
| <b>Application Data Sheet 37 CFR 1.76</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                       | Attorney Docket Number | 1009-6397 / P109171US01 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                       | Application Number     |                         |
| Title of Invention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Suspend Resume for UEs with LTM related configuration |                        |                         |
| <small>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.<br/>This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</small> |                                                       |                        |                         |

## Secrecy Order 37 CFR 5.2:

|                          |                                                                                                                                                                                                                                       |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> | Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.) |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Inventor Information:

|                                                                                                                                                                          |            |                                   |             |        |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------------------------------|-------------|--------|--------|
| Inventor 1                                                                                                                                                               |            |                                   |             |        | Remove |
| Legal Name                                                                                                                                                               |            |                                   |             |        |        |
| Prefix                                                                                                                                                                   | Given Name | Middle Name                       | Family Name | Suffix |        |
|                                                                                                                                                                          | Icaro      | Leonardo                          | Da Silva    |        |        |
| Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |            |                                   |             |        |        |
| City                                                                                                                                                                     | Solna      | Country of Residence <sup>i</sup> | SE          |        |        |
|                                                                                                                                                                          |            |                                   |             |        |        |
| Mailing Address of Inventor:                                                                                                                                             |            |                                   |             |        |        |
| Address 1                                                                                                                                                                |            | Bergshamra Allé 175               |             |        |        |
| Address 2                                                                                                                                                                |            |                                   |             |        |        |
| City                                                                                                                                                                     | Solna      | State/Province                    |             |        |        |
| Postal Code                                                                                                                                                              | 170 77     | Country <sup>i</sup>              | SE          |        |        |
| Inventor 2                                                                                                                                                               |            |                                   |             |        | Remove |
| Legal Name                                                                                                                                                               |            |                                   |             |        |        |
| Prefix                                                                                                                                                                   | Given Name | Middle Name                       | Family Name | Suffix |        |
|                                                                                                                                                                          | Pontus     |                                   | Wallentin   |        |        |
| Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |            |                                   |             |        |        |
| City                                                                                                                                                                     | Linköping  | Country of Residence <sup>i</sup> | SE          |        |        |
|                                                                                                                                                                          |            |                                   |             |        |        |
| Mailing Address of Inventor:                                                                                                                                             |            |                                   |             |        |        |
| Address 1                                                                                                                                                                |            | Trastgatan 3                      |             |        |        |
| Address 2                                                                                                                                                                |            |                                   |             |        |        |
| City                                                                                                                                                                     | Linköping  | State/Province                    |             |        |        |
| Postal Code                                                                                                                                                              | 582 39     | Country <sup>i</sup>              | SE          |        |        |
| Inventor 3                                                                                                                                                               |            |                                   |             |        | Remove |
| Legal Name                                                                                                                                                               |            |                                   |             |        |        |

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| <b>Application Data Sheet 37 CFR 1.76</b> |  | Attorney Docket Number                                |  | 1009-6397 / P109171US01 |  |
|                                           |  | Application Number                                    |  |                         |  |
| Title of Invention                        |  | Suspend Resume for UEs with LTM related configuration |  |                         |  |

|                                                                                                                                                                                 |                   |                                          |                    |               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------------------------|--------------------|---------------|
| <b>Prefix</b>                                                                                                                                                                   | <b>Given Name</b> | <b>Middle Name</b>                       | <b>Family Name</b> | <b>Suffix</b> |
|                                                                                                                                                                                 | Stefan            |                                          | Wager              |               |
| <b>Residence Information (Select One)</b> <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |                   |                                          |                    |               |
| <b>City</b>                                                                                                                                                                     | Espoo             | <b>Country of Residence <sup>i</sup></b> | FI                 |               |
|                                                                                                                                                                                 |                   |                                          |                    |               |

**Mailing Address of Inventor:**

|                                                                                                                                                                                 |                   |                                          |                    |                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------------------------|--------------------|---------------------------------------------------------------------------|
| <b>Address 1</b>                                                                                                                                                                |                   | Övergårdsvägen 41 D                      |                    |                                                                           |
| <b>Address 2</b>                                                                                                                                                                |                   |                                          |                    |                                                                           |
| <b>City</b>                                                                                                                                                                     | Espoo             | <b>State/Province</b>                    |                    |                                                                           |
| <b>Postal Code</b>                                                                                                                                                              | 02360             | <b>Country <sup>i</sup></b>              | FI                 |                                                                           |
| Inventor 4                                                                                                                                                                      |                   |                                          |                    | <a href="#" style="border: 1px solid black; padding: 2px 5px;">Remove</a> |
| <b>Legal Name</b>                                                                                                                                                               |                   |                                          |                    |                                                                           |
| <b>Prefix</b>                                                                                                                                                                   | <b>Given Name</b> | <b>Middle Name</b>                       | <b>Family Name</b> | <b>Suffix</b>                                                             |
|                                                                                                                                                                                 | Ioanna            |                                          | Pappa              |                                                                           |
| <b>Residence Information (Select One)</b> <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |                   |                                          |                    |                                                                           |
| <b>City</b>                                                                                                                                                                     | Stockholm         | <b>Country of Residence <sup>i</sup></b> | SE                 |                                                                           |
|                                                                                                                                                                                 |                   |                                          |                    |                                                                           |

**Mailing Address of Inventor:**

|                                                                                                                                                                                 |                   |                                          |                    |                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------------------------|--------------------|---------------------------------------------------------------------------|
| <b>Address 1</b>                                                                                                                                                                |                   | Fatburs Brunnsgata 11, 3tr               |                    |                                                                           |
| <b>Address 2</b>                                                                                                                                                                |                   |                                          |                    |                                                                           |
| <b>City</b>                                                                                                                                                                     | Stockholm         | <b>State/Province</b>                    |                    |                                                                           |
| <b>Postal Code</b>                                                                                                                                                              | 118 28            | <b>Country <sup>i</sup></b>              | SE                 |                                                                           |
| Inventor 5                                                                                                                                                                      |                   |                                          |                    | <a href="#" style="border: 1px solid black; padding: 2px 5px;">Remove</a> |
| <b>Legal Name</b>                                                                                                                                                               |                   |                                          |                    |                                                                           |
| <b>Prefix</b>                                                                                                                                                                   | <b>Given Name</b> | <b>Middle Name</b>                       | <b>Family Name</b> | <b>Suffix</b>                                                             |
|                                                                                                                                                                                 | Antonino          |                                          | Orsino             |                                                                           |
| <b>Residence Information (Select One)</b> <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |                   |                                          |                    |                                                                           |
| <b>City</b>                                                                                                                                                                     | Kirkkonummi       | <b>Country of Residence <sup>i</sup></b> | FI                 |                                                                           |
|                                                                                                                                                                                 |                   |                                          |                    |                                                                           |

**Mailing Address of Inventor:**

|                    |             |                             |    |  |
|--------------------|-------------|-----------------------------|----|--|
| <b>Address 1</b>   |             | Pranglintie 8 B             |    |  |
| <b>Address 2</b>   |             |                             |    |  |
| <b>City</b>        | Kirkkonummi | <b>State/Province</b>       |    |  |
| <b>Postal Code</b> | 02480       | <b>Country <sup>i</sup></b> | FI |  |

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| <b>Application Data Sheet 37 CFR 1.76</b> |                                                       | Attorney Docket Number | 1009-6397 / P109171US01 |
|                                           |                                                       | Application Number     |                         |
| Title of Invention                        | Suspend Resume for UEs with LTM related configuration |                        |                         |

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button.

## Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.  
For further information see 37 CFR 1.33(a).

☐ An Address is being provided for the correspondence information of this application.

|                 |                       |                                          |                                             |
|-----------------|-----------------------|------------------------------------------|---------------------------------------------|
| Customer Number | 102721                |                                          |                                             |
| Email Address   | official@mbhiplaw.com | <input type="button" value="Add Email"/> | <input type="button" value="Remove Email"/> |

## Application Information:

|                                         |                                                       |                                           |                          |
|-----------------------------------------|-------------------------------------------------------|-------------------------------------------|--------------------------|
| Title of the Invention                  | Suspend Resume for UEs with LTM related configuration |                                           |                          |
| Attorney Docket Number                  | 1009-6397 / P109171US01                               | Small Entity Status Claimed               | <input type="checkbox"/> |
| Application Type                        | Provisional                                           |                                           |                          |
| Subject Matter                          | Utility                                               |                                           |                          |
| Total Number of Drawing Sheets (if any) | 4                                                     | Suggested Figure for Publication (if any) |                          |

## Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

|                                                        |                          |                                            |
|--------------------------------------------------------|--------------------------|--------------------------------------------|
| Application number of the previously filed application | Filing date (YYYY-MM-DD) | Intellectual Property Authority or Country |
|                                                        |                          |                                            |

## Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

## Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

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| <b>Application Data Sheet 37 CFR 1.76</b> |                                                       | Attorney Docket Number                       | 1009-6397 / P109171US01                                 |
|                                           |                                                       | Application Number                           |                                                         |
| Title of Invention                        | Suspend Resume for UEs with LTM related configuration |                                              |                                                         |
|                                           |                                                       |                                              |                                                         |
| Please Select One:                        | <input checked="" type="radio"/> Customer Number      | <input type="radio"/> US Patent Practitioner | <input type="radio"/> Limited Recognition (37 CFR 11.9) |
| Customer Number                           | 102721                                                |                                              |                                                         |

## Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

|                                                                                                                       |                 |                          |                                    |
|-----------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------|------------------------------------|
| Prior Application Status                                                                                              |                 | <a href="#">Remove</a>   |                                    |
| Application Number                                                                                                    | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
|                                                                                                                       |                 |                          |                                    |
| Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the <b>Add</b> button. |                 |                          | <a href="#">Add</a>                |

## Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)<sup>i</sup> the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

|                                                                                                        |                      |                          |                                          |
|--------------------------------------------------------------------------------------------------------|----------------------|--------------------------|------------------------------------------|
| Application Number                                                                                     | Country <sup>i</sup> | Filing Date (YYYY-MM-DD) | <a href="#">Remove</a>                   |
|                                                                                                        |                      |                          | Access Code <sup>i</sup> (if applicable) |
| Additional Foreign Priority Data may be generated within this form by selecting the <b>Add</b> button. |                      |                          | <a href="#">Add</a>                      |

## Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

- ☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
- NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

|                                                                                                                                                                                                                                           |                                                       |                         |                    |                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------|--------------------|-------------------------------------------------------|
| <b>Application Data Sheet 37 CFR 1.76</b>                                                                                                                                                                                                 | Attorney Docket Number                                | 1009-6397 / P109171US01 |                    |                                                       |
|                                                                                                                                                                                                                                           | Application Number                                    |                         |                    |                                                       |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%; padding: 5px;">Title of Invention</td> <td style="padding: 5px;">Suspend Resume for UEs with LTM related configuration</td> </tr> </table> |                                                       |                         | Title of Invention | Suspend Resume for UEs with LTM related configuration |
| Title of Invention                                                                                                                                                                                                                        | Suspend Resume for UEs with LTM related configuration |                         |                    |                                                       |

## Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

**NOTE:** This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

### 1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

**A. Priority Document Exchange (PDX)** - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

**B. Search Results from U.S. Application to EPO** - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

### 2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

**NOTE:** Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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| <b>Application Data Sheet 37 CFR 1.76</b> | Attorney Docket Number                                | 1009-6397 / P109171US01 |
|                                           | Application Number                                    |                         |
| Title of Invention                        | Suspend Resume for UEs with LTM related configuration |                         |

## Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                        |                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------|
| <b>Applicant 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <a href="#">Remove</a>                                                 |                                      |
| If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section. |                                                                        |                                      |
| <a href="#">Clear</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                        |                                      |
| <input type="radio"/> Assignee                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <input type="radio"/> Legal Representative under 35 U.S.C. 117         | <input type="radio"/> Joint Inventor |
| <input checked="" type="radio"/> Person to whom the inventor is obligated to assign.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <input type="radio"/> Person who shows sufficient proprietary interest |                                      |
| If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                        |                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                        |                                      |
| Name of the Deceased or Legally Incapacitated Inventor: <input type="text"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                        |                                      |
| If the Applicant is an Organization check here. <input checked="" type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                        |                                      |
| Organization Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Telefonaktiebolaget LM Ericsson (publ)                                 |                                      |
| <b>Mailing Address Information For Applicant:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                        |                                      |
| Address 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SE-164 83                                                              |                                      |
| Address 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                        |                                      |
| City                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Stockholm                                                              | State/Province                       |
| Country                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | SE                                                                     | Postal Code                          |
| Phone Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                        | Fax Number                           |
| Email Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | official@mbhiplaw.com                                                  |                                      |
| Additional Applicant Data may be generated within this form by selecting the Add button. <a href="#">Add</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                        |                                      |

## Assignee Information including Non-Applicant Assignee Information:

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| <b>Application Data Sheet 37 CFR 1.76</b> | Attorney Docket Number                                | 1009-6397 / P109171US01 |
|                                           | Application Number                                    |                         |
| Title of Invention                        | Suspend Resume for UEs with LTM related configuration |                         |

**Assignee 1**

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|                                           |                                                       | Application Number     |                         |
| Title of Invention                        | Suspend Resume for UEs with LTM related configuration |                        |                         |

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**63/519,012**

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### Title of Invention

Suspend Resume for UEs with LTM related configuration

### Application Information

APPLICATION TYPE Utility - Provisional Application under  
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PATENT # -

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FILED BY Kate Canes

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FILING DATE -

CUSTOMER # 102721

FIRST NAMED INVENTOR Icaro Leonardo Da Silva

CORRESPONDENCE ADDRESS -

AUTHORIZED BY Michael Murphy

### Documents

**TOTAL DOCUMENTS: 2**

| DOCUMENT                        | PAGES | DESCRIPTION            | SIZE (KB) |
|---------------------------------|-------|------------------------|-----------|
| 1009-6397 ADS.pdf               | 9     | Application Data Sheet | 2174 KB   |
| 1009-6397 Application Parts.pdf | 90    | Specification          | 2849 KB   |

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1009-6397 Application Parts.pdf 9B1621AB49761B3E8ED4154663865725B059D354C8A0FFF805  
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## SUSPEND RESUME FOR UEs WITH LTM RELATED CONFIGURATION

### INTRODUCTION

[0001] In NR, a UE in RRC\_CONNECTED receives RRCRelease message including a suspendConfig to suspend its connection and to enter RRC\_INACTIVE, as shown below for the case of a split architecture, in which a gNodeB is split in two parts connected via an interface (FIAP): a Central Unit (CU) and at least one Distributed Unit. Below we show the steps between the UE, the gNB-DU (or simply DU) and the gNB-CU (or simply CU):

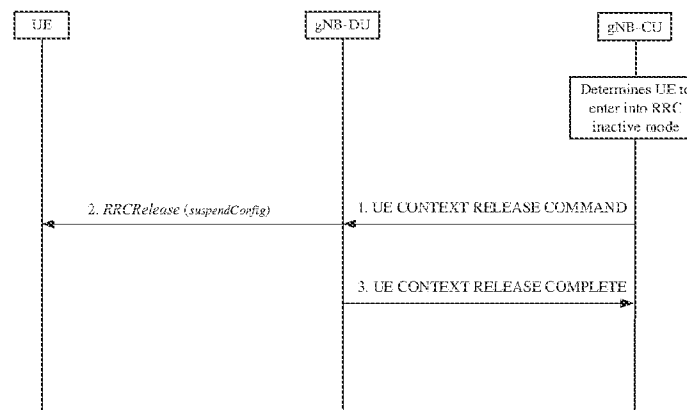


Figure 1 RRC\_CONNECTED to RRC\_INACTIVE transition

0. At first, the gNB-CU determines that the UE is to enter into RRC inactive mode (RRC\_INACTIVE), i.e., transition to RRC\_INACTIVE from the RRC connected mode (RRC\_CONNECTED).
1. The gNB-CU generates *RRCRelease* message which includes a suspend configuration towards UE (suspendConfig). The RRC message is encapsulated in UE CONTEXT RELEASE COMMAND message sent to the gNB-DU.
2. The gNB-DU forwards the *RRCRelease* message to the UE, upon which the UE enters RRC\_INACTIVE and store information in the UE Inactive AS Context.
3. The gNB-DU responds with UE CONTEXT RELEASE COMPLETE message.

[0002] A UE in RRC\_INACTIVE may transition to RRC\_CONNECTED in an RRC resume procedure, as shown below for a split architecture, with the UE context fetched from the last serving gNodeB (a last serving target gNodeB-CU, not shown in the figure below) in which the UE has been suspended.

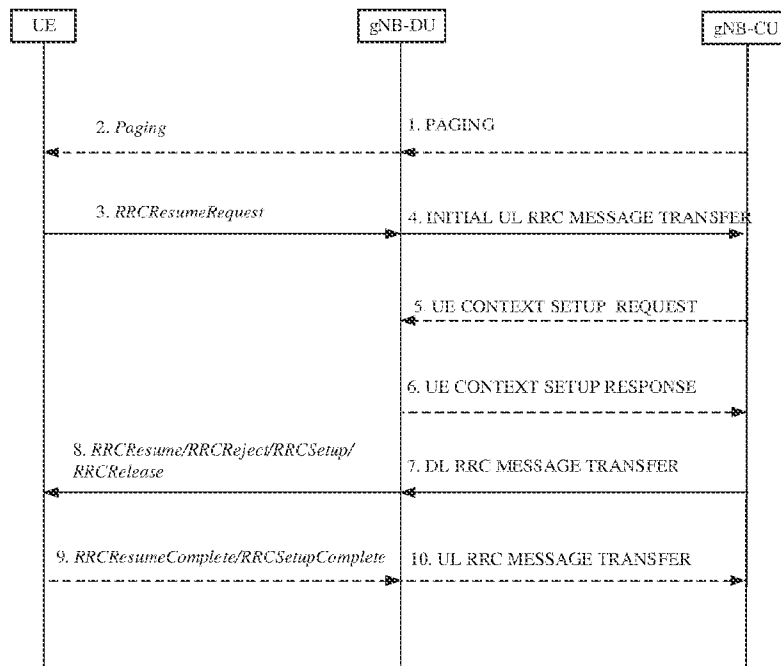


Figure 2 RRC\_INACTIVE to RRC\_CONNECTED transition

[0003] When the connection is to be resume, the following steps at the target CU and the target DU are performed:

1. If data is received from the 5G Core (5GC), the gNB-CU sends PAGING message to the gNB-DU.
2. The gNB-DU sends *Paging* message to UE.

NOTE: Steps 1 and 2 only exist in case of DL data arrival.

3. The UE sends *RRCResumeRequest* message either upon RAN-based paging, UL data arrival or RNA update.
4. The gNB-DU includes *RRCResumeRequest* in a non-UE associated INITIAL UL RRC MESSAGE TRANSFER message and transfer to the gNB-CU.
5. For UE Inactive to UE Active transitions (i.e. from RRC\_INACTIVE to RRC\_CONNECTED), excluding transitions due to signalling exchange only, the gNB-CU allocates gNB-CU UE F1AP ID and sends UE CONTEXT SETUP REQUEST message to gNB-DU, which may include SRB ID(s) and DRB ID(s) to be setup, CellGroupConfig stored in gNB-CU or retrieved from the old NG-RAN node may also be included. In case of NG-RAN sharing, the gNB-CU includes the serving PLMN ID (in case of SNPNs the serving NID).
6. The gNB-DU responds with UE CONTEXT SETUP RESPONSE message, which contains RLC/MAC/PHY configuration of SRB and DRBs provided by the gNB-DU.
7. The gNB-CU generates *RRCResume* message towards the UE. The RRC message is encapsulated in DL RRC MESSAGE TRANSFER message together with SRB ID.

8. The gNB-DU forwards RRC message to the UE either over SRB0 or SRB1 as indicated by the SRB ID.
9. The UE sends *RRCResumeComplete* message to the gNB-DU.
10. The gNB-DU encapsulates RRC in UL RRC MESSAGE TRANSFER message and send to the gNB-CU.

L1/L2-triggered mobility, also referred to as lower layer triggered mobility or "LTM"

[0004] Until Release 17, serving cell changes for a UE were triggered by Layer 3 measurements and carried out via RRC signaling. Layer 3 based mobility involved reconfiguration of upper layers of the radio protocol stack, e.g., the RRC and/or PDCP layers, and/or resetting of the lower layers, e.g., MAC and/or PHY layers. LTM offers a mechanism for retaining the upper-layer configuration and minimizing changes to the lower-layer configuration. Here, an example control-plane protocol stack includes the RRC layer, with a PDCP layer below it, a RLC layer below the PDCP layer, a MAC layer below the RLC layer, and a PHY layer below the MAC layer. Continuing the example case, the PHY layer is considered Layer 1, while Layer 2 includes the MAC, RLC, and PDCP layers, with Layer 3 including the RRC layer.

[0005] A basic principle with LTM is that the UE is configured by the network with an RRC configuration per LTM candidate cell, sometimes also known as a LTM candidate cell configuration. Such a LTM candidate cell configuration may be in the form of an RRCReconfiguration message or one or more IEs/ fields/ parameters such as CellGroupConfig. The UE performs measurements on these LTM candidate cells and transmits corresponding measurement reports to the network. The network then triggers the execution of a LTM cell switch procedure in the UE by transmitting a lower layer signal (such as a MAC CE or DCI), sometimes also referred to as a LTM cell switch command, to the UE, which then connects to the target cell and switches to a LTM candidate cell configuration.

[0006] The stage-2 signaling in the latest version of the running CR for TS 38.401 is shown below for intra-DU and inter-DU [2]:

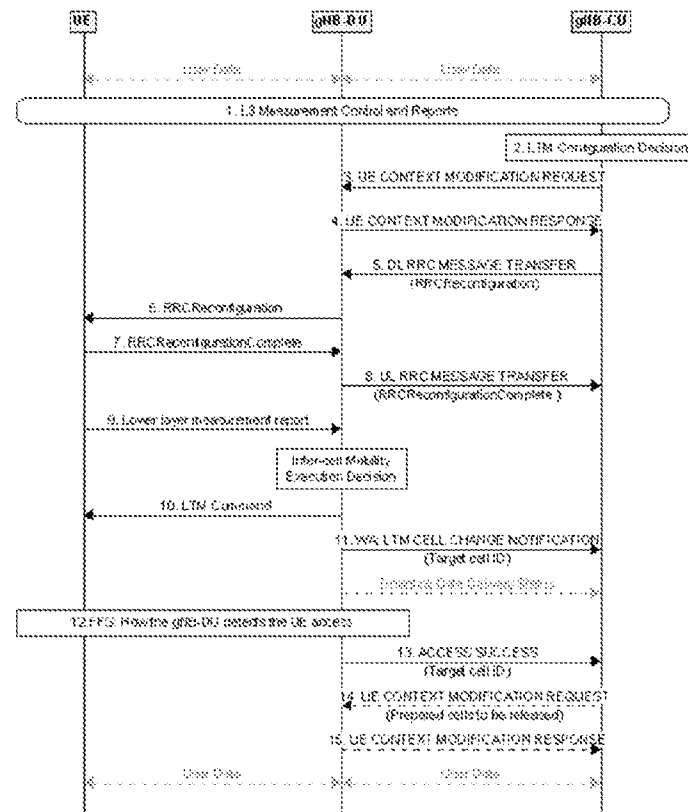


Figure 3 Intra-gNB-DU LTM

1. The UE sends a *MeasurementReport* message (L3 measurement result for further study (FFS)) to the gNB-DU containing measurements of neighboring cells. The gNB-DU sends an UL RRC MESSAGE TRANSFER message conveying the received *MeasurementReport* message to the gNB-CU.
2. The gNB-CU determines to initiate LTM configuration.
3. The gNB-CU sends a UE CONTEXT MODIFICATION REQUEST message to the gNB-DU containing one target candidate cell ID.
4. If the gNB-DU accepts the request of LTM configuration, it responds to the gNB-CU with a UE CONTEXT MODIFICATION RESPONSE message including the generated lower layer RRC configurations for the accepted target candidate cell.  
FFS for Step 3 and Step 4: either a single or multiple UE Context Modification procedure(s) should be used.
5. The gNB-CU sends a DL RRC MESSAGE TRANSFER message to the gNB-DU, which includes the generated *RRCReconfiguration* message with the LTM configuration.  
FFS: whether it is DL RRC MESSAGE TRANSFER message or UE CONTEXT MODIFICATION REQUEST message.

6. The gNB-DU forwards the received *RRCReconfiguration* message to the UE.
7. The UE responds to the gNB-DU with an *RRCReconfigurationComplete* message.
8. The gNB-DU forwards the *RRCReconfigurationComplete* message to the gNB-CU via an UL RRC MESSAGE TRANSFER message.
- 5       FFS: whether it is UL RRC MESSAGE TRANSFER message or UE CONTEXT MODIFICATION RESPONSE message.
9. The UE sends the lower layer measurement result to the gNB-DU. The gNB-DU decides to execute LTM.
10. The gNB-DU sends the LTM command to the UE.
- 10   11. WA: The gNB-DU sends the LTM CELL CHANGE NOTIFICATION message to the gNB-CU to indicate the initiation of the LTM command to the UE including the target cell ID.
12. FFS: How the target gNB-DU detects the UE access.
13. The target gNB-DU sends the ACCESS SUCCESS message to the gNB-CU with the target Cell ID.
14. The gNB-CU may send the UE CONTEXT MODIFICATION message to the gNB-DU to release the resources of prepared cells.
- 15   15. The gNB-DU responds with a UE CONTEXT MODIFICATION RESPONSE message.

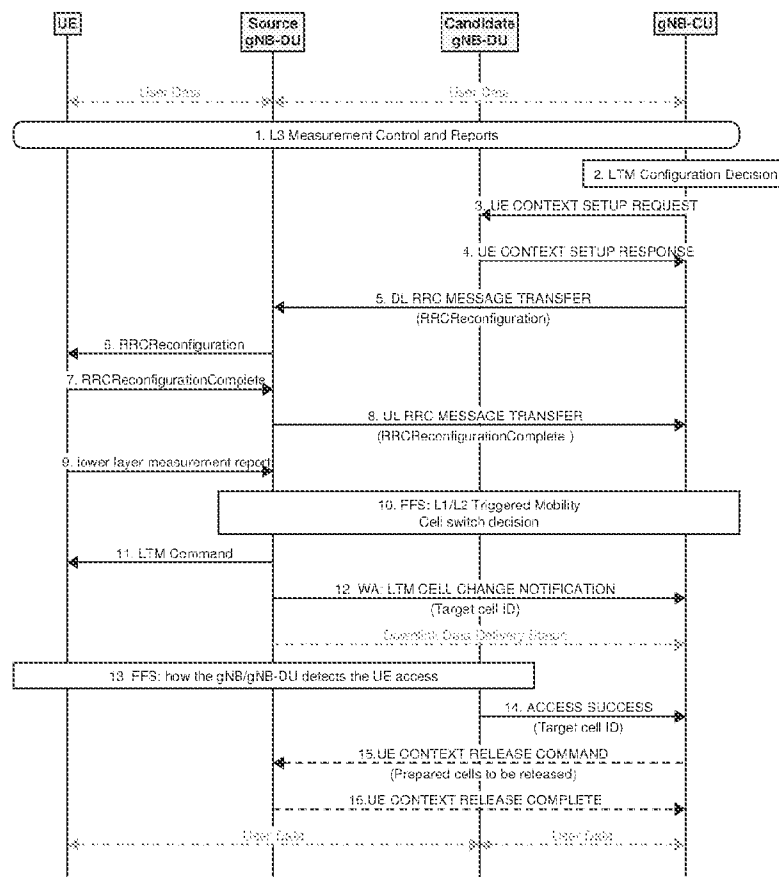


Figure 4 inter gNB-DU LTM

1. The UE sends a *MeasurementReport* message (L3 measurement result FFS) to the source gNB-DU containing measurements of neighboring cells. The source gNB-DU sends an UL RRC MESSAGE TRANSFER message conveying the received *MeasurementReport* message to the gNB-CU.
  2. The gNB-CU determines to initiate LTM configuration.
  3. The gNB-CU sends a UE CONTEXT SETUP REQUEST message to the candidate gNB-DU, containing one target candidate cell ID.
  4. If the candidate gNB-DU accepts the request of LTM configuration, it responds to the gNB-CU with a UE CONTEXT SETUP RESPONSE message including the generated lower layer RRC configuration for the accepted target candidate cell.
  5. The gNB-CU sends a DL RRC MESSAGE TRANSFER message to the source gNB-DU, which includes the generated *RRCReconfiguration* message with the LTM configuration.
- FFS: whether it is DL RRC MESSAGE TRANSFER message or UE CONTEXT MODIFICATION

REQUEST message.

6. The source gNB-DU forwards the received *RRCreconfiguration* message to the UE.
7. The UE responds to the source gNB-DU with an *RRCreconfigurationComplete* message.
8. The source gNB-DU forwards the *RRCreconfigurationComplete* message to the gNB-CU  
5 via an UL RRC MESSAGE TRANSFER message.

FFS: whether it is UL RRC MESSAGE TRANSFER message or UE CONTEXT MODIFICATION RESPONSE message.

9. The UE sends the lower layer measurement result to the source gNB-DU.
10. The source gNB-DU decides to execute LTM to a candidate target cell.
- 10 FFS: Notifying the LTM triggering decision to the other nodes as well.
11. The source gNB-DU sends LTM command to the UE.

Editor's note: The LTM command needs to be updated according to RAN2's discussion.

12. WA: The source gNB-DU sends the LTM CELL CHANGE NOTIFICATION message to the gNB-CU to indicate the initiation of the LTM command to the UE including the target  
15 cell ID.

13. FFS: how the target gNB-DU detects the UE access.

14. The target gNB-DU sends the ACCESS SUCCESS message to the gNB-CU with the target cell ID.

15. The gNB-CU may send the UE CONTEXT RELEASE COMMAND message to the source  
20 gNB-DU to release the resources of prepared cells.

16. The source gNB-DU responds with a UE CONTEXT RELEASE COMPLETE message.

#### UL pre-sync with LTM candidate cell(s)

- [0007] In order to support a Random access Channel (RACH)-less procedure (i.e. an LTM  
25 cell switch in which the UE does not need to transmit a RACH preamble), the network can configure the UE to perform an UL pre-sync (pre- synchronization), which may also be called a Timing Advance (TA) acquisition procedure, by transmitting a preamble to an LTM candidate cell (time/ frequency domain RACH resource(s)) which enables a Candidate DU to calculate a TA value to be applied by the UE and provided to the UE in an LTM Cell Switch  
30 Command (e.g. MAC CE), so that the UE is considered to be UL synchronized (or UL synched) without the need to perform a random access procedure at the time of the LTM cell switch.

[0008] The below diagram illustrates some steps of the TA establishment procedure as proposed by the Ericsson contribution R2-2306011 [1]:

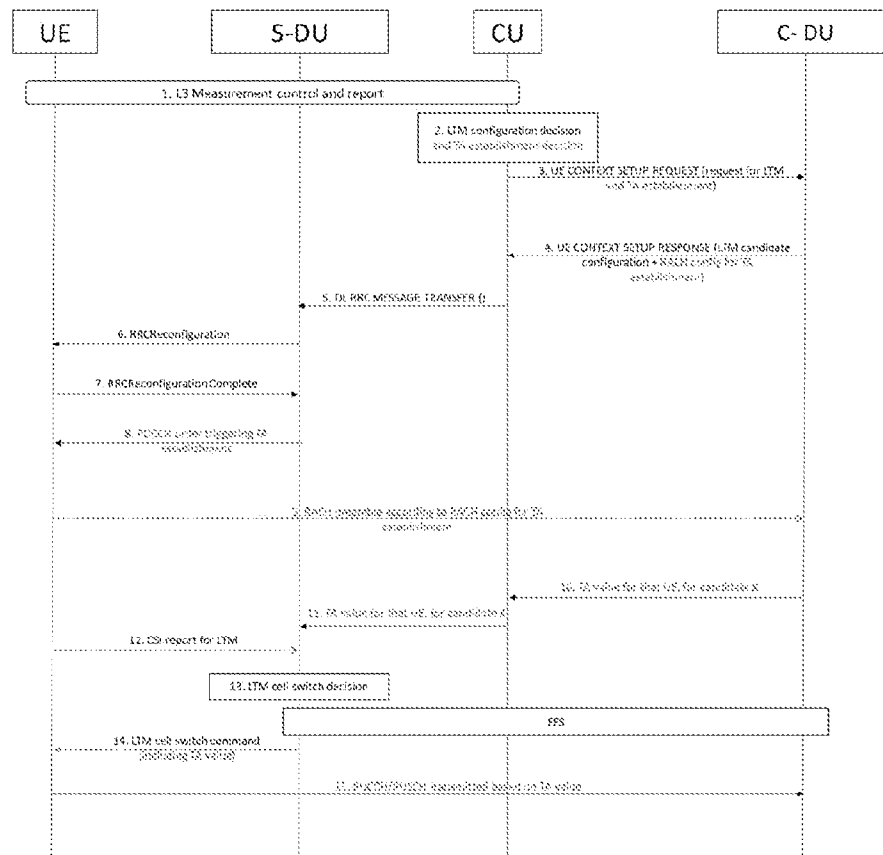


Figure 5 Signaling flow for inter-DU LTM configuration with TA establishment configuration and triggering

[0009] As proposed in [1], the configuration of TA establishment should be only triggered by the CU i.e., only CU-initiated TA acquisition procedure should be supported, as the CU knows which LTM candidate cells would be UL sync or not with each other. There are at least two different points in time in which the CU triggers the TA establishment procedure:

- i) when an LTM candidate is being configured or;
- ii) at a later moment, an LTM candidate cell for which a TA value is unknown.

[0010] For the first case, the CU determines to configure an LTM candidate cell of a C-DU based on L3 measurement reports. Assuming that the CU is aware which LTM candidate cells are UL sync or not with the UE's current serving cell, the CU may also include in the UE CONTEXT SETUP REQUEST to a C-DU the request for configuring an LTM candidate cell and a request for initiating a time alignment acquisition procedure associated to the requested LTM candidate cell(s). The case in which the CU may request to initiate the TA establishment

procedure to a C-DU is (ii) when an LTM candidate cell is already configured e.g., in response to L3 measurements, but its TA value is not known. In that case, as a context already exists in the C-DU, the request for initiating the TA establishment procedure may be included in a UE Context Modification Request.

5 [0011] If the C-DU accepts the request for initiating the TA establishment procedure, the C-DU responds to the CU with a UE CONTEXT SETUP RESPONSE message including a random access (RA) configuration for the TA establishment, where this configuration should include at least Random Access Preamble indices and RACH occasions with the associated SSB indices for each LTM candidate cell configured for TA establishment as agreed by RAN1.

10 Thus:

- The RACH configuration for the TA establishment procedure includes Access Preamble indices and RACH occasions with the associated SSB indices for each LTM candidate cell configured to perform a TA establishment procedure.
  - If the C-DU accepts the request for initiating a TA establishment procedure, the C-DU
- 15 sends to the CU a dedicated RACH configuration for the TA establishment procedure (e.g., in UE Context Setup Response and UE Context Modification Response).

[0012] When the CU receives from the C-DU the RACH configuration for the TA establishment procedure, the CU encapsulates it in an RRC configuration to be provided to the UE. In case the TA establishment is being configured when an LTM candidate is being added,

20 the CU also needs to generate an RRC message to include the overall LTM configuration (e.g., a full RRCReconfiguration message), so the RACH configuration for the TA establishment may be included in the same RRC message. A further option is that in case the TA establishment is being configured for an LTM candidate cell already configured at the UE, the CU may also generate an RRC message to modify the LTM configuration, so the RACH

25 configuration for TA establishment may be included in the same RRC message.

[0013] Thus, the UE receives the RACH configuration for the TA establishment procedure within the same RRCReconfiguration message that is used for adding or modifying an LTM candidate cell configuration.

#### DL pre-sync with LTM candidate cell(s)

30 [0014] RAN1 has agreed that an indication of a beam or a TCI state (e.g. a TCI state index or some form of TCI identifier) will be included in the LTM cell switch command (i.e. MAC CE indicating the UE to perform LTM cell switch to an LTM candidate cell), with the intention that the UE identifies a TCI state of the LTM candidate cell during LTM cell switch. In addition, RAN1 has also agreed that the UE may receive the indication of a TCI state of an

LTM candidate cell even before the LTM cell switch command is received, in a procedure which is sometimes called DL pre-sync with LTM candidate cell(s), since the TCI state ID provided even before the LTM cell switch command.

[0015] An example of a signaling flow between CU, S-DU and C-DU is provided below for the case in which the TCI state ID for an LTM candidate is included in a MAC CE received by the UE for pre-activating a TCI state before the reception of an LTM cell switch command, as proposed in [2]:

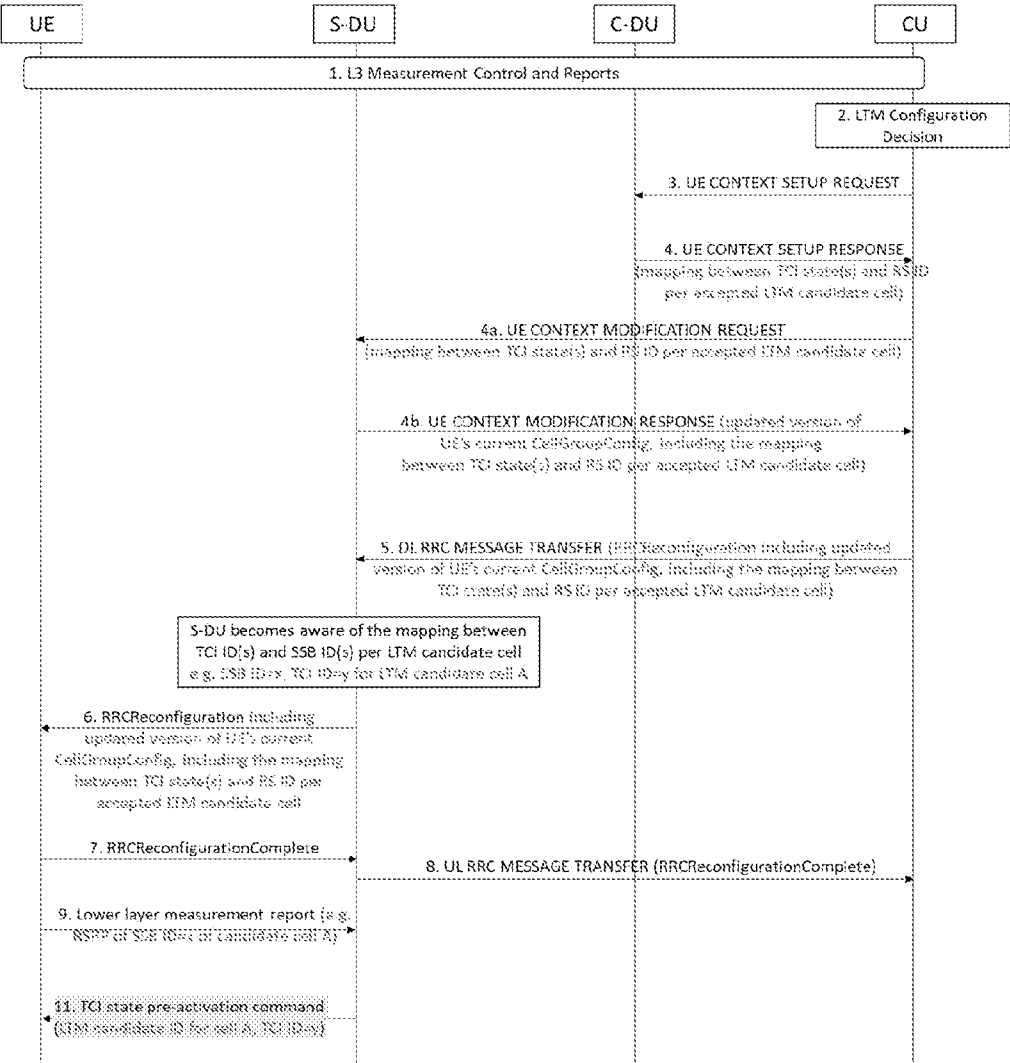


Figure 6 DL pre-sync and provision of TCI state ID of a candidate before an LTM cell switch command

3GPP Dual Connectivity

[0016] In 3GPP Rel-12, the LTE feature Dual Connectivity (DC) was introduced, to enable the UE to be connected in two cell groups, each controlled by an LTE access node, eNBs,

labelled as the Master eNB, MeNB and the Secondary eNB, SeNB. The UE still only has one RRC connection with the network. In 3GPP, the Dual Connectivity (DC) solution has since then been evolved and is now also specified for NR as well as between LTE and NR. With introduction of 5G, the term MR-DC (Multi-Radio Dual Connectivity, see also 3GPP TS 37.340) was defined as a generic term for all dual connectivity options which includes at least one NR access node. Using the MR-DC generalized terminology, the UE is connected in a Master Cell Group (MCG), controlled by the Master Node (MN), and in a Secondary Cell Group (SCG) controlled by a Secondary Node (SN).

[0017] Further, in MR-DC, when dual connectivity is configured for the UE, within each of the two cell groups, MCG and SCG, carrier aggregation may be used as well. In this case, within the Master Cell Group, MCG, controlled by the master node (MN), the UE may use one PCell and one or more SCell(s). And within the Secondary Cell Group, SCG, controlled by the secondary node (SN), the UE may use one Primary SCell (PSCell, also known as the primary SCG cell in NR) and one or more SCell(s). This combined case is illustrated in Figure 7. In NR, the primary cell of a master or secondary cell group is sometimes also referred to as the Special Cell (SpCell). Hence, the SpCell in the MCG is the PCell and the SpCell in the SCG is the PSCell.

[0018] A special case of MR-DC is when both the MCG and the SCG use NR. This case is also known as NR Dual Connectivity, NR-DC

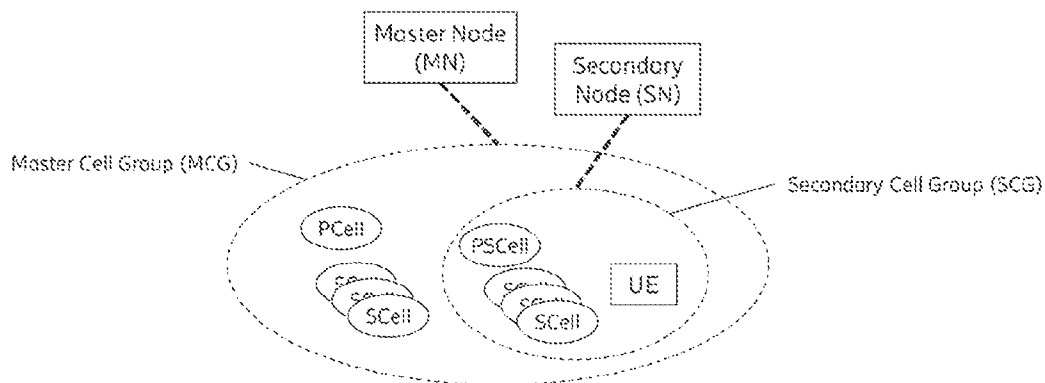


Figure 7. Illustration of dual connectivity combined with carrier aggregation in MR-DC

[0019] There currently exist certain challenge(s). One problem addressed by the techniques disclosed herein is reducing or eliminating indeterminate or ambiguous behaviors in suspend/resume scenarios. Consider a UE being configured with LTM related configurations, such as LTM candidate cell configurations, UL pre-sync configuration(s) and DL pre-sync configuration(s), and some other configuration(s), a reference configuration, the

complete LTM configuration per LTM candidate cell the UE generates when configured with LTM, and some other LTM related configurations, e.g., L2 reset information for LTM. The UE then receives an indication from the network to suspend the connection (e.g. RRC Release message including a suspendConfig) and, absent the advantageous techniques disclosed herein, is not able to determine whether these configurations should be released and/or stored (suspended) while the UE is RRC\_INACTIVE and/or when the UE tries to resume. That may create a mismatch between UE and the network concerning the configurations in the UE Inactive AS context, in which configurations are supposed to be stored when the UE is in RRC\_INACTIVE.

[0020] A configuration mismatch may lead to a reconfiguration failure every time a resume procedure is attempted, which would lead to a re-establishment procedure or a transition to RRC\_IDLE, leading to an increased network signaling and UE power consumption. In addition, if the UE decides to release the LTM related configurations while the network keeps them, it would have been a waste at the network side to keep these resources, since they would not be utilized when the UE tries to resume.

[0021] Certain aspects of the disclosure and their embodiments may provide solutions to these or other challenges.

[0022] Example UE-related embodiments for the suspend operation include:

**A first method at a UE (deleting LTM related configurations)**

A1. A method performed by a UE, the method comprising:

- Receiving a first set of one or more LTM related configuration(s);
- Receiving a message from the network to suspend the connection, and transitioning to Inactive state;
- Deleting (releasing/ discarding/ removing) the first set of one or more LTM related configurations in response to one or more of the following events:
  - o Receiving the message from the network to suspend the connection, or
  - o During an initiation of a resume procedure.

A2. A method according to A1, wherein the first set of one or more LTM related configurations comprise:

- o i) Lower layer (CSI) measurement configuration(s) for LTM;
- o ii) Time Alignment acquisition (also called UL pre-sync configuration);
- o iii) TCI state configuration(s) for pre-sync (also called DL pre-sync configuration);
- o iv) LTM Reference configuration(s);
- o v) LTM Candidate Cell Configuration (s);

- vi) Complete LTM candidate configuration(s) generated when the UE is configured with LTM.

A3. A method according to A1, further comprising initiating a resume procedure, transmitting an RRC Resume Request message, and receiving an RRC Resume message including a second set of one or more LTM related configuration(s).

A4. A method according to A3, wherein the second set of one or more LTM related configuration(s) may be the same or different than the first set of one or more LTM related parameters.

A5. A method according to A1 and A3, wherein the UE first releases/discards/removes the first set of LTM related configuration(s) and then applies the second set of one or more LTM related configuration(s).

A6. A method according to A1, wherein the UE is in multi-radio dual connectivity (MR-DC or NR-DC) and the first set of one or more LTM related configurations is for the Master Cell Group (MCG) or the Secondary Cell Group (SCG).

#### **A second method at a UE (storing / restoring LTM related configurations)**

B1. A method performed by a UE, the method comprising:

- Receiving a first set of one or more LTM related configuration(s);
- Receiving a message from the network to suspend the connection, and transitioning to Inactive state;
- Storing the first set of one or more LTM related configurations in response to receiving the message from the network to suspend the connection.

B2. A method according to B1, wherein the first set of one or more LTM related configurations comprise:

- i) Lower layer (CSI) measurement configuration(s) for LTM;
- ii) Time Alignment acquisition (also called UL pre-sync configuration);
- iii) TCI state configuration(s) for pre-sync (also called DL pre-sync configuration);
- iv) LTM Reference configuration(s);
- v) LTM Candidate Cell Configuration (s);
- vi) Complete LTM candidate cell configuration(s) generated when the UE is configured with LTM.

B3. A method according to B1, further comprising initiating a resume procedure, transmitting an RRC Resume Request message and receiving an RRC Resume message including first indication (e.g., restore LTM field) and, in response to the first indication, restoring the first set of stored LTM related configuration(s).

B4. A method according to B1, further comprising initiating a resume procedure, transmitting an RRC Resume Request message, receiving an RRC Resume message and upon determining that first indication is absent, deleting the first set of LTM related configuration(s).

B5. A method according to B1-B3, wherein the RRC Resume message further comprises a second set of one or more related LTM configuration(s), which is applied by the UE as part of the RRC resume procedure.

5 B6. A method according to B4, wherein the second set of one or more related LTM configuration(s) may be the same or different than the first set of one or more LTM related parameters.

B7. A method according to B1 and B4, wherein the second set of one or more related LTM configuration(s) add/modify/release the first set of LTM related configuration(s).

10 B8. A method according to B1, wherein the UE is in multi-radio dual connectivity (MR-DC or NR-DC) and the first set of one or more LTM related configurations is for the MCG or the SCG.

B9. A method according to B3-B4 and B7, wherein the first indication is a restoreSCG indication.

#### A first method of operation by a Network Node (Serving CU)

15 C1. A method performed by a first network node operating as a Central Unit (CU) serving a UE (or serving CU), the method comprising:

- Transmitting to the UE a first set of one or more LTM related configuration(s);
- Transmitting a message to the UE network to suspend the connection and to transition the UE to Inactive state;
- 20 - Deleting (releasing/ discarding/ removing) the first set of one or more LTM related configurations in response to one or more of the following events:
  - o Transmitting the message to the UE to transition the UE to Inactive state; or
  - o During an initiation of a resume procedure.

25 C2. The method of C1, wherein deleting (releasing/ discarding/ removing) the first set of one or more LTM related configurations further comprises the CU transmitting a release message to at least one Candidate DU for releasing the first set of LTM related configuration(s) at the Candidate DU, wherein the first set of LTM related configuration(s) is associated to an LTM candidate cell of the at least one Candidate DU.

30 C3. (UE resume in the same CU) The method of C1, further comprising receiving from the UE an RRC Resume Request message and transmitting an RRC Resume message including a second set of one or more LTM related configuration(s), wherein the second set of one or more LTM related configuration(s) may be the same or different than the first set of one or more LTM related parameters.

#### A second method of operation by a Network Node (Serving CU)

D1. A method performed by a first network node operating as a Central Unit (CU) serving a UE

(or serving CU), the method comprising:

- Transmitting to the UE a first set of one or more LTM related configuration(s);
- Transmitting a message to the network to suspend the connection and to transition the UE to Inactive state;
- 5     - Storing the first set of one or more LTM related configurations in response to transmitting the message to the UE to transition the UE to Inactive state.

D2. A method according to D1, wherein the first set of one or more LTM related configurations comprise:

- 10     ○ i) Lower layer measurement configuration(s) for LTM;
- ii) Time Alignment acquisition (also called UL pre-sync configuration);
- iii) TCI state configuration(s) for pre-sync (also called DL pre-sync configuration);
- iv) LTM Reference configuration(s);
- v) LTM Candidate Cell Configuration (s);
- 15     ○ vi) Complete LTM candidate cell configuration(s) generated when the UE is configured with LTM.

D3. A method according to D1, further comprising receiving from the UE an RRC Resume Request message and transmitting an RRC Resume message including first indication (e.g. restore) which indicates to the UE that the UE shall restore the first set of stored LTM related configuration(s).

20     D4. A method according to D1, further comprising receiving an RRC Resume Request message, and transmitting an RRC Resume message with first indication being absent, to indicate that the UE shall delete the first set of LTM related configuration(s).

25     D5. A method according to D1-D3, wherein the RRC Resume message further comprises a second set of one or more related LTM configuration(s) to be applied by the UE as part of the RRC resume procedure.

D6. A method according to D4, wherein the second set of one or more related LTM configuration(s) may be the same or different than the first set of one or more LTM related parameters.

30     D7. The method according to D1, wherein upon storing the first set of one or more LTM related configurations, transmitting a message to a Candidate DU associated to the first set of one or more LTM related configuration(s) to indicate that the first set of one or more LTM related configurations is suspended.

35     D8. The method according to D1, wherein the first network node receives a message requesting UE Context from a second network node, based on which the first network node deletes the first set of LTM related configuration(s) from a UE Inactive AS Context before it responds including in the response message the UE Inactive AS Context (without the first set of LTM related configuration(s)).

40     [0023] Certain embodiments may provide one or more of the following technical advantage(s). According to the disclosed techniques, there is no mismatch between the UE and

the network when the UE transitions from RRC\_INACTIVE to RRC\_CONNECTED when the UE was configured with LTM related configuration(s) before being transitioned to RRC\_INACTIVE. Preventing a mismatch prevents a reconfiguration failure every time a resume procedure is attempted, which prevents a re-establishment procedure or a transition to RRC\_IDLE, and makes the resumption of the connection successful, which reduces the network signaling and UE power consumption.

[0024] In addition to these benefits on the UE, the different network nodes involved in these steps, such as the Serving CU and the one or more Candidate DU(s), are also not having a mismatch between configurations which are stored or not when the UE is suspended and a resumption is attempted.

#### ADDITIONAL EXPLANATION

[0025] Some of the embodiments contemplated herein will now be described more fully with reference to the accompanying drawings. Embodiments are provided by way of example to convey the scope of the subject matter to those skilled in the art.

[0026] The text refers to the term “L1/L2 based inter-cell mobility” as used in the Work Item Description in 3GPP, though it interchangeably also uses the terms L1/L2 mobility, L1-mobility, L1 based mobility, L1/L2-centric inter-cell mobility, L1/L2 inter-cell mobility L1/L2-Triggered Mobility (LTM), Lower-layer triggered Mobility or simply LTM, as more widely used. The basic principle is that the UE receives a lower layer signaling from the network (e.g. a MAC Control Element – MAC CE) indicating to the UE a change (or switch or activation) of its serving cell (e.g. change of PCell, from a source to a target PCell), wherein a lower layer signaling is a message/ signaling of a lower layer protocol, which may be referred as a L1/L2 inter-cell mobility execution command or LTM cell switch command. The change of serving cell (e.g. change of PCell) may also lead to a change in SCell(s) for the same cell group e.g. in case the command triggers the UE to change to another cell group configuration of the same type (e.g. another MCG configuration). Before the UE receives the LTM cell switch command, the UE is configured by the network with one or more LTM candidate cell configuration (e.g. reception of an RRC Reconfiguration message, with at least one LTM candidate cell configuration) A LTM candidate cell configuration may include parameters in the IE CellGroupConfig per candidate cell and/or an embedded RRC Reconfiguration per LTM candidate cell.

[0027] The term LTM cell switch procedure refers to the process of a UE switching (or changing) its cell from a source cell to a target cell (which may be called here an LTM candidate

cell or a neighbour cell), using L1/L2-triggered mobility (aLTM). In the context of L1/L2-triggered mobility (LTM), an LTM cell switch procedure may sometimes also be known as L1/L2 based inter-cell mobility execution, LTM execution, dynamic switch, LTM switch, (LTM) cell switch, (LTM) serving cell change or (LTM) cell change. In the context of this disclosure, switching to the LTM candidate cell configuration comprises the UE considering that an LTM candidate cell becomes its new special cell (SpCell) e.g. PCell in case of LTM being configured for a Master Cell Group (MCG) and/or PSCell in case of LTM being configured for a Secondary Cell Group (SCG); or, changing its SpCell from the current PCell to an LTM candidate cell.

[0028] Even if the term change of cell is used, that may comprise a change of a whole cell group configuration, which includes a change in the SpCell (e.g. change of PCell, or change of PSCell) and a change in SCells of the cell group (e.g. addition, modification and/or release of one or more SCells).

[0029] An LTM cell switch procedure may be triggered in the UE by reception of a LTM cell switch command, or alternatively, triggered by some other event, such as a condition, e.g., a triggering condition used for conditional configuration, such as conditional handover, being fulfilled, as a result of recovery from radio link failure or handover failure.

[0030] The text refers to a LTM candidate cell, which is a cell the UE is configured with when configured with L1/L2-triggered mobility. That is a cell the UE can move to in a LTM cell switch procedure, upon reception of a LTM cell switch command. These cells may also be called candidate cell(s), candidates, mobility candidates, non-serving cells, additional cells, target candidate cell, target candidate, etc. A LTM candidate cell is a cell the UE perform measurements on (e.g. CSI measurements) so that the UE reports these measurements and network may take educated decision on which beam (e.g. TCI state) and/or cell the UE is to be switched to. An LTM candidate cell may be a candidate to be a target PCell or PSCell, or an SCell of a cell group (e.g. MCG SCell). In the case of an LTM fast recovery, when a failure is detected, the UE selects a cell and when the cell is an LTM candidate cell the UE does not have to perform re-establishment, but instead performs an LTM cell switch towards the selected LTM candidate cell e.g. by applying the LTM candidate cell configuration associated to the selected LTM candidate cell.

[0031] The text refers to at least one LTM candidate cell configuration and that the UE has received at least one LTM candidate cell configuration. This is also sometimes referred to as a configuration of a LTM candidate cell, which may be an RRC configuration, such as

encapsulated in an RRC Reconfiguration message, that the UE receives when being configured with L1/L2-Triggered Mobility. A **LTM candidate cell configuration** comprises the configuration which the UE needs to start to operate accordingly when it performs an **LTM cell switch procedure** to that LTM candidate cell e.g. upon reception of the **LTM cell switch command** indicating the UE to perform a **LTM cell switch procedure** to that LTM candidate cell, which becomes the target cell and the current (new) SpCell, or an SCell in a serving frequency. The **LTM candidate cell configuration** comprises parameters of a serving cell (or multiple serving cells, such as a cell group), comprising one or more of the groups of parameters, such as an RRCReconfiguration message an IE CellGroupConfig or an IE SpCellConfig (or the IE SCellConfig, in the case of a Secondary Cell). A **LTM candidate cell configuration** may in one example comprise one or more of: i) the PCell configuration and one or more SCell configuration(s) of a Master Cell Group (MCG); i) the PSCell configuration and one or more SCell configuration(s) of a secondary Cell Group (SCG). The terms (LTM) candidate configuration, LTM configuration, (LTM) candidate target cell configuration, (LTM) target candidate (cell) configuration may be used interchangeably when referring to **LTM candidate cell configuration**. An **LTM candidate cell configuration** is associated with an identifier which is used in the signaling when referring to a certain **LTM candidate cell configuration**, such as when the UE receives the **LTM candidate cell configuration** and when the UE receives an **LTM cell switch command** indicating the UE to perform a **LTM cell switch procedure** to that LTM candidate cell. This identifier is sometimes known as the **LTM candidate cell configuration identity** or LTM candidate configuration index (or similar).

**[0032]** The actual **LTM candidate cell configuration** and its exact content and/or structure of this IE and/or embedded message may be called an RRC model for the candidate configuration, or simply RRC model. An **LTM candidate cell configuration** comprises the configuration which the UE needs to operate accordingly when it performs (executes) L1/L2 based inter-cell mobility execution to a LTM candidate cell, upon reception of the lower layer signaling (MAC CE) indicating a L1/L2 based inter-cell mobility to a LTM candidate cell (which becomes the target cell and the current (new) PCell, or an SCell in a serving frequency), or upon reception of the lower layer signaling (MAC CE) indicating a L1/L2 based inter-cell mobility to a **LTM candidate cell configuration** indicated with a candidate configuration index (sometimes also denoted candidate configuration ID). The UE may be configured with multiple **LTM candidate cell configurations**, so a Candidate DU generates and sends to the CU multiple configuration(s). The actual **LTM candidate cell configuration** the UE receives during the LTM configuration may

be a delta signaling to be applied on top of a reference configuration, so that the actual configuration the UE is to use in the candidate cell upon LTM cell switch is the combination of the ~~the candidate cell configuration~~ and the reference configuration (e.g. separately signaled by the network to the UE).

- 5 [0033] The term “beam” may correspond to a spatial direction in which a signal is transmitted (e.g. by a network node) or received (e.g. by the UE), or a spatial filter applied to a signal which is transmitted or received. Thus, transmitting signals different beams could correspond to transmitting signals in different spatial directions. When the text refers to a “beam which is selected” it may refer to a beam index and/or a Reference Signal (RS) index or  
 10 identifier, such as a Synchronization Signal block (SSB) index, or a CSI-RS resource identifier. Thus, selecting a beam may correspond to selecting an SSB, associated to an SSB index. Or, selecting a beam may correspond to selecting a CSI-RS, associated to a CSI-RS resource identifier.

#### System overview

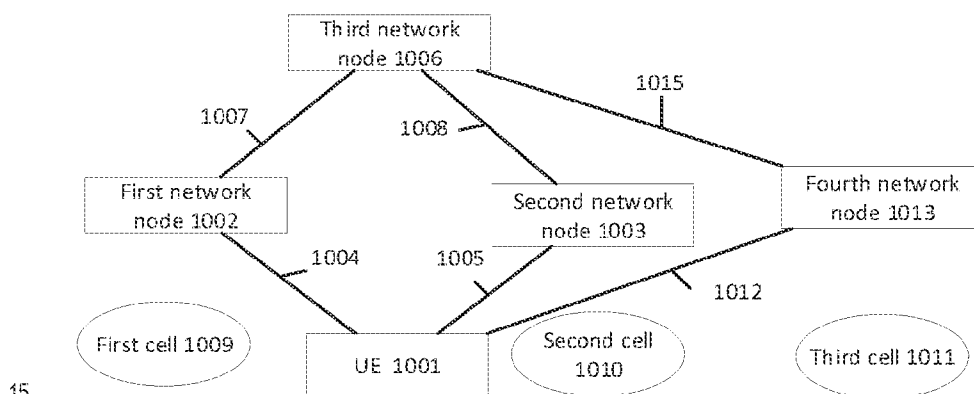


Figure 8. System structure used in one or more example embodiments

- Figure 8Figure 8 illustrates a system structure including the entities involved in one or more example embodiments. The User Equipment (UE) 1001 is a wireless terminal, such as a cellular smartphone, sometimes connected to the first network node 1002 over a wireless interface 1004 and sometimes, such as a result of a mobility procedure, connected to a second network node 1003, to which the UE 1001 is connected over a wireless interface 1005.  
 20 The first network node 1002, controls a first cell 1009 (sometimes called serving cell, Special Cell (SpCell), or Primary Cell, PCell). The second network node 1003 controls a second cell 1010, which is sometimes referred to as LTM candidate cell or target cell.  
 25 Each of first network node 1002 and the second network node 1003 may be a base station

such as e.g. gNB, or, e.g. in case of a distributed CU/DU RAN architecture, a distributed unit, sometimes known as either gNB-DU or DU. The first network node 1002 is sometimes referred to as serving DU, the second network node 1003 is sometimes referred to as candidate DU or target DU. The first network node and the second node may be the same  
 5 network node.

The first network node 1002 and the second network node 1003 are connected to a third network node 1006, sometimes also referred to as serving network node. The third network node 1006 may, e.g. in case of a distributed CU/DU RAN architecture, be a central unit, CU, sometimes referred to as the serving CU, known as either a gNB-CU, CU, gNB-CU-CP or gNB-  
 10 CU-UP, or a core network node such as a User Plane Function, UPF or an Access and Mobility management Function, AMF.

In some cases, the UE is sometimes configured with Multi-Radio Dual Connectivity, MR-DC sometimes also referred to as NR dual connectivity, NR-DC. In these cases, the UE is configured with a Master Cell Group (MCG), controlled by the Master Node (MN),  
 15 sometimes known as a Master gNB, MgNB, and in a Secondary Cell Group (SCG) controlled by a Secondary Node (SN) sometimes known as a Secondary gNB, SgNB. In these cases, the first network node 1002, the second network node 1003 and the third network node may belong to the Master Node, MN, and the UE is also connected, over a wireless interface 1012, to a fourth network node 1013 which may belong to the Secondary Node, SN. Further, the  
 20 first cell 1009 may in these cases belong to the Master Cell Group, MCG and a third cell 1011, controlled by the fourth network node 1013 may belong to the Secondary Cell Group, SCG. The third cell 1011 is sometimes referred to as serving cell, Special Cell (SpCell), or Primary SCG Cell, PSCell, or alternatively LTM candidate cell or target cell. Further, in these cases, the fourth network node 1013 is connected with the third network node 1006  
 25 over an interface 1015 which may be an Xn type of interface.

Embodiments disclosed herein involve respective or complementary methods of operation by a UE and a network node, for so-called LTM related configuration(s) e.g. storing, removing, deleting. In this section, different options are shown for what the LTM related configuration(s) may correspond to i.e. a first set of LTM related configuration(s) or a second  
 30 set of LTM related configuration(s) may correspond to one or more of the following:

- **i) Lower layer measurement configuration(s) for LTM:**
  - o The lower layer measurement configuration comprises the configuration the UE receives for performing measurements on one or more LTM candidate cells (e.g. on SSBs and/or beams and/or CSI-RS resources of these LTM candidate cells), so that

the UE reports these lower layer measurements to the network to assist the network to perform LTM cell switch decisions. These reports may include e.g. SS-RSRP and/or L1-RSRP, SS-RSRQ and/or L1-RSRQ, SS-SINR and/or L1-SINR, SS-SINR and/or L1-SINR.

- 5
  - In one option, the lower layer measurement configuration comprises one or more reporting configuration(s) included in a serving cell configuration (e.g. ServingCellConfig, as part of a CSI measurement configuration, or LTM measurement configuration) of a serving cell (e.g. PCell or an MCG SCell) in which lower layer measurement reports for LTM are to be reported. The reporting configuration(s)
    - 10 may include one or more parameters indicating how the UE is meant to perform the reporting e.g. periodic, aperiodic, semi-persistently, etc. An instance of a reporting configuration may be defined in the IE CSI-ReportConfig, or a new IE called LTM-CSI-ReportConfig.
      - 15
        - When the UE removes the lower layer measurement configuration(s) the UE removes the LTM related reporting configuration(s) from each serving cell configuration (e.g. CSI measurement configuration on each SCell configuration and CSI measurement configuration on the SpCell configuration)
    - In one option, a reporting configuration indicates which LTM candidate cell(s) are to be reported according to that reporting configuration.
    - 20
      - In one option, the lower layer measurement configuration comprises one or more resource configuration(s) e.g. indicating what was to be measured by the UE, such as one or more LTM candidate cell(s) and/or one or more Reference Signals of an LTM candidate cell (e.g. SSB(s) and/or CSI-RS resource(s)).
        - 25
          - In one sub-option, a resource configuration is included within each LTM candidate cell configuration e.g. in the lower layer measurement configuration;
          - In another sub-option, a resource configuration is included within the overall LTM candidate cell which the UE receives when the UE is configured with LTM e.g. an instance of the IE LTM-CSI-ResourceConfig, included within the IE LTM-Config. In that case, a resource configuration may refer to one or more LTM candidate cells, e.g., by referring to one or more LTM candidate identifier(s).
      - 30
        - In one option, the lower layer measurement configuration further includes one or more of:
          - 35
            - Indication of the frequency of the SS/PBCH block associated to an LTM-Candidate
            - Subcarrier spacing of SSB.
            - Periodicity of the SS/PBCH block are given in number of subframe
            - 40
              - Indication of the time domain positions of the transmitted SS-blocks in a half frame with SS/PBCH blocks.
            - Average EPRE of the resources elements that carry secondary synchronization signals in dBm that the NW used for SSB transmission of the LTM-Candidate.
            - 45
              - PCI of the LTM-Candidate.
              - list of LTM-CSI-ResourceConfig(s)
              - list of ltm-CSIResourceConfig to be released
              - A group of one or more LTM-CSI-SSB-ResourceSet.
              - An SS/PBCH block resource set from one or more candidate cells.
              - 50
                - Identification of an SS/PBCH block resource set
                - Indication of SS/PBCH block resources from one or more candidate cells

- Indication of the physical cell IDs (PCIs) of the SSBs in the LTM-CSI-SSB-Resourcelist

5           ○ **Advantage:** Thanks to the methods the mismatch between UE and network for this specific configuration is prevented i.e. both the UE and the network are aligned on whether the UE needs to perform lower layer measurements or not. That saves UE power, and prevents UL interference on the network side, which may degrade the UE's performance and other UE's performance. A mismatch in this case could be the UE performing lower layer measurements after resumption unnecessarily, leading to a waste of UE power. In addition to this, the UE may possibly try to report lower layer measurements over an UL channel of a serving cell after resumption of the connection, while the network is not even prepared to receive these measurements, which may lead to an UL interference, which may degrade the UE's UL performance or/(and the performance at the network for other UEs (in addition to the additional UL power to transmit these lower layer measurements). Another possible mismatch which is prevented by the method is the one in which the network expects lower layer measurements for LTM while the UE is not performing these measurements. In that case, the main issue that is prevented by the method is the waste of resources on the network side, since UL resources would not be needed on the network as the UE is not even performing these measurements.

- **ii) Time Alignment acquisition configuration(s) (also called UL pre-sync configuration):**
  - The Time Alignment acquisition configuration, also called Uplink (UL) pre-sync configuration, comprises the necessary configuration(s) the UE receives to transmit an UL message to an LTM candidate cell (e.g. a random access preamble to a Physical Random Access Channel time/ frequency resource); thanks to that the network (e.g. Candidate DU) calculates a Timing Advance (TA) value to that LTM candidate cell, so that in an LTM cell switch to that LTM candidate cell, the UE receives that TA value (e.g. in or with the LTM cell switch command) and applies that TA value to be UL synchronized with the LTM candidate cell.
  - In one option, the TA acquisition configuration (or UL pre-sync configuration) is received by the UE per LTM candidate cell;
  - In one option, the TA acquisition configuration (or UL pre-sync configuration) comprises one or more random access related parameters such as:
    - one or more indication(s) of one or more preamble (e.g. per beam(s) and/ or SSB(s)) e.g. random access Preamble indices
    - one or more indication(s) of random access occasions with the associated SSB indices configured for each candidate cell.
    - One or more parameters associated to power ramping for preamble transmission / re-transmission
  - In one option, the TA acquisition configuration (or UL pre-sync configuration e.g. IE EarlyUL-SyncConfig) is included within a configuration per LTM candidate cell (e.g. IE LTM-Candidate) which the UE receives when the UE is configured with LTM.
  - **Advantage:** Thanks to the methods the mismatch between UE and network for this specific configuration is prevented i.e. both the UE and the network are aligned on whether the UE is configured for TA acquisition or not. A mismatch in this case could be the UE having random access related configurations for TA acquisition and possibly getting prepared in case the network sends the PDDCH order triggering a

preamble transmission, but due to the mismatch that never happens (as network may believe the UE does not have the TA acquisition configuration stored). These UE actions could be considered wasted and consume UE power unnecessarily, which is what is prevented thanks to the method. In addition to it, another issue which is prevented by the method is that the UE would not receive a PDCCH by the network for transmitting a preamble without having a TA acquisition configuration, which may have caused a reconfiguration failure, or some other kind of unexpected error cases when the UE receives a PDCCH order intended for a given RRC configuration which the UE does not have available.

- **iii) TCI state configuration(s) for pre-sync (also called DL pre-sync configuration):**

- The TCI configuration for pre-sync, also called Downlink (DL) pre-sync configuration, comprises the necessary configuration(s) the UE receives for obtaining DL pre-sync with an LTM candidate cell, such as one or more indications of reference signals e.g. SSB indexes and/or CSI-RS resource identifiers and associated configuration(s).
- In one option, TCI configuration for pre-sync, also called DL pre-sync configuration, is received by the UE per LTM candidate cell e.g. in the IE LTM-Candidate;
- In one option, TCI configuration for pre-sync, also called DL pre-sync configuration, comprises one or more TCI state configuration(s) e.g. ltm-CandidateTCI-States-ToAddModList-r18 of IE(s) CandidateTCI-StatesToAddModList-r18;
- In one option, TCI configuration for pre-sync, also called DL pre-sync configuration, comprises one or more of:
  - A list of TCI states indicating a transmission configuration which includes Quasi-Co-Location (QCL)-relationships between the DL RSs (e.g. SSB indices and/or CSI-RS resource identifiers and/or TRS identifiers) in one RS set and the Physical Downlink Shared Channel (PDSCH) Demodulation Reference Signal (DMRS) ports
  - A list of UL TCI states for an LTM candidate cell
  - The unified TCI state type the UE is configured for an LTM candidate cell
  - Association between one or two DL reference signals with a corresponding quasi-colocation (QCL) type
- In one option, TCI configuration for pre-sync, also called DL pre-sync configuration, is included within each LTM candidate cell configuration;
- In one option, TCI configuration for pre-sync, also called DL pre-sync configuration (e.g. ltm-CandidateTCI-States-ToAddModList-r18    CandidateTCI-StatesToAddModList-r18) is included within a configuration per LTM candidate cell (e.g. IE LTM-Candidate) which the UE receives when the UE is configured with LTM.
- **Advantage:** Thanks to the methods the mismatch between UE and network for this specific configuration is prevented i.e. both the UE and the network are aligned on whether the UE is configured for DL pre-sync based on TCI state(s) configuration(s) of LTM candidates. A mismatch in this case could be the UE having these TCI configuration and performing DL pre-sync operation(s) on them, such as measurements on SSB and/or CSI-RS resources, while the network would never transmit an LTM cell switch command which may benefit from it. These UE actions could be considered wasted and consume UE power unnecessarily, which is what is prevented thanks to the method. In addition to it, another issue which is prevented by the method is that the UE would not receive a DL pre-sync command by the network (e.g. MAC CE indicating a MAC CE before the UE receives the LTM cell switch command) without the UE having a DL pre-sync acquisition configuration, which could have caused a reconfiguration failure, or some other kind of unexpected

error cases when the UE receives a MAC CE intended for a given TCI state configuration which the UE does not have available.

- 5       - **iv) LTM Reference configuration(s);**
- The reference configuration or LTM Reference Configuration comprises a configuration provided by the network to the UE that is common to multiple configured LTM candidate cells. It is used by the UE to generate a complete LTM candidate cell configuration (i.e., by applying an LTM candidate cell configuration on top of an LTM reference configuration).
  - 10       ○ In one option, the reference configuration is configured as an RRC Reconfiguration message, e.g. within the IE LTM-Config, as follows:

```

LTM-Config-r18 ::= SEQUENCE {
  [...]
  ltm-ReferenceConfiguration-r18      OCTET STRING (CONTAINING RRCReconfiguration),
  OPTIONAL,
  [...]
  [...]
}

```

- 20       - **v) LTM Candidate Cell Configuration (s);**
- The LTM candidate cell configuration is a configuration associated with an LTM candidate cell. An LTM candidate cell configuration can be a complete LTM candidate cell configuration or a delta (difference) configuration with respect to an LTM reference configuration.
  - 25       ○ In one option, the LTM candidate configuration is configured as a list of RRC reconfiguration messages, e.g. as follows:

```

LTM-CandidateToAddModList-r18 ::= SEQUENCE (SIZE (1..maxNrofCellsLTM-r18)) OF LTM-Candidate-r18

LTM-Candidate-r18 ::= SEQUENCE {
  ltm-CandidateId-r18      LTM-CandidateId-r18,
  ltm-CandidateConfig-r18  OCTET STRING (CONTAINING
  RRCReconfiguration),
  OPTIONAL,
  [...]
  [...]
}

```

- 35       - **vi) Complete LTM candidate cell configuration(s) generated when the UE is configured with LTM.**
- The complete LTM candidate configuration(s) comprises the complete LTM candidate configuration for each LTM candidate cell, also called Complete LTM Candidate Cell Configuration, defined as a configuration that contains all the necessary fields needed to perform an LTM cell switch procedure. This configuration can be an LTM candidate cell configuration itself or be generated by applying an LTM candidate cell configuration on top of an LTM reference configuration.
  - 40       ○ The Complete LTM Candidate Cell Configuration is generated by the UE by applying the LTM candidate cell configuration (e.g. IE ) on top of the LTM Reference configuration, by performing one or more of the following steps:

1> if there is no entry in *ue-ltm-ConfigCandidateList* within *VarLTM-UE-Config* with *ltm-CandidateId* value set to the value of *ltm-CandidateId* included in the *LTM-Candidate*:

2> create an entry in *ue-ltm-ConfigCandidateList* within *VarLTM-UE-Config* with value *ltm-CandidateId*;

- 2> set to the value of *lrm-CandidateId* in that entry to the value included in the *LTM-Candidate*; 1> in the entry of *ue-lrm-ConfigCandidateList* within *VarLTM-UE-Config* with *lrm-CandidateId* set to the value of *lrm-CandidateId* value included in the *LTM-Candidate*:
- 2> if the *LTM-Candidate* includes *lrm-ConfigComplete*;
- 5           3> consider the received *lrm-CandidateConfig* within *lrm-Candidate* as a complete LTM candidate cell configuration;
- 3> if *ue-LTM-config* is present within *VarLTM-UE-Config*:
- 4> replace *ue-LTM-Config* with the *lrm-CandidateConfig* included in the *LTM-Config*;
- 3> else:
- 10           4> store in *ue-LTM-Config* the *lrm-CandidateConfig* included in the *LTM-Config*;
- 2> else:
- 3> generate a complete LTM candidate cell configuration by applying *lrm-CandidateConfig* on top of *lrm-referenceConfiguration*, according to clause 5.3.5.x.5.3> *ue-LTM-config* is present within *VarLTM-UE-Config* :
- 15           4> replace *ue-LTM-Config* with the generated complete LTM candidate cell configuration;
- 3> else:
- 4> store in *ue-LTM-Config* the generated complete LTM candidate cell configuration;
- **Advantage:** Thanks to the methods the mismatch between UE and network for this specific configuration is prevented i.e. both the UE and the network are aligned on whether the UE is configured with a certain reference configuration or not.
- 20
- **vi) Other LTM related configurations, such as:**
- The configuration(s) indicating whether the UE performs a Layer 2 reset or not, when LTM cell switch is to be performed from a cell A to a cell B, e.g., the field *lrm-ServingCellNoResetID-r18* of IE INTEGER (1.. *maxNrofCellsLTM-r18-plus-1*);
- 25           ○ Indication on whether LTM fast recovery is to be performed or not e.g. *attempt-LTM* which may be set to 'TRUE' and, when included, indicates that LTM fast recovery is to be performed by the UE when a failure is triggered e.g. UE performs LTM cell switch when a selected cell while timer T311 is running is an LTM candidate cell.
- 30           ○ The actual LTM candidate cell configuration (delta signaling based on the reference configuration) e.g. the *lrm-CandidateConfig-r18* OCTET STRING (CONTAINING RRCReconfiguration) within the IE *LTM-Candidate*.
- **Advantage:** Thanks to the methods the mismatch between UE and network for this specific configuration is prevented i.e. both the UE and the network are aligned on whether the UE is configured with a certain reference configuration or not.
- 35

In a set of embodiments performed by a UE, the UE performs the following actions:

- Receiving a first set of one or more LTM related configuration(s);

- In one option that first set of one or more LTM related configuration(s) is received in a message which corresponds to an RRC Reconfiguration message, which the UE may receive in different manners e.g. when it transition to RRC\_CONNECTED (e.g. from RRC\_IDLE), or during a handover and/or during a reconfiguration with sync, or from the serving cell for intra-cell reconfiguration.
- In one option that first set of one or more LTM related configuration(s) is received when the UE is capable of handling one or more of the LTM related configuration(s). For example, the UE receives in the first set an UL pre-sync configuration(s) when the UE is capable of performing UL pre-sync for LTM.
- Receiving a message from the network to suspend the connection and transitioning to Inactive state e.g. RRC\_INACTIVE;
  - In one option that message from the network to suspend the connection and transitioning to Inactive state corresponds to an RRC Release message including a suspend configuration (suspendConfig).
- Deleting (releasing/ discarding/ removing) the first set of one or more LTM related configurations in response to one or more of the following events:
  - Receiving the message from the network to suspend the connection;
    - In one option, this is modeled as follows in the RRC specifications:

\*\*\*\*\*  
\*\*\*\*\*

### 5.3.8.3 Reception of the RRCRelease by the UE

The UE shall:

[...]

1> if the RRCRelease includes suspendConfig:

[...]

2> remove all entries within the MCG VarLTM-UE-Config, if any;

2> remove all entries within the MCG VarLTM-Config, if any;

2> remove LTM-Config for LTM on the MCG, if any;

2> remove the ltm-CSI-ReportConfigToAddModList instances for all MCG Serving cells;

2> if the RRCRelease message with suspendConfig was received in response to an RRCResumeRequest or an RRCResumeRequest1:

[...]

2> else:

3> store in the UE Inactive AS Context the nextHopChainingCount received in the RRCRelease message, the current  $K_{gNB}$  and  $K_{RRCInt}$  keys, the ROHC state, the EHC context(s), the stored QoS flow to DRB mapping rules, the C-RNTI used in the source PCell, the cellIdentity and the physical cell identity of the source PCell, the spCellConfigCommon within ReconfigurationWithSync of the NR PSCell (if configured) and all other parameters configured except for:

- parameters within *ReconfigurationWithSync* of the PCell;
- parameters within *ReconfigurationWithSync* of the NR PSCell, if configured;
- parameters within *MobilityControlInfoSCG* of the E-UTRA PSCell, if configured;
- *servingCellConfigCommonSIB*;

5       - *LTM-Config and other LTM related configuration(s)*;

[...]

2> enter RRC\_INACTIVE and perform cell selection as specified in TS 38.304 [20];

1> else

2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with the release cause 'other'.

10       \*\*\*\*\*  
\*\*\*\*\*

- Or During an initiation of a resume procedure.

- In one option, this is modeled as follows in the RRC specifications (no exception added for storing in the UE Inactive AS Context, and removal is done in resume initiation):

\*\*\*\*\*  
\*\*\*\*\*

### 5.3.13 RRC connection resume

20       [...]

#### 5.3.13.2 Initiation

[...]

Upon initiation of the procedure, the UE shall:

[...]

25       1> if the UE is in NE-DC or NR-DC:

2> if the UE does not support maintaining SCG configuration upon connection resumption:

3> release the MR-DC related configurations (i.e., as specified in 5.3.5.10) from the UE Inactive AS context, if stored;

1> if the UE is configured with LTM related configuration(s):

30       2> if the UE does not support maintaining LTM related configurations upon connection resumption:

3> release the LTM related configuration(s) from the UE Inactive AS context, if stored;

4> remove all entries within the MCG VarLTM-UE-Config, if any;

4> remove all entries within the MCG VarLTM-Config, if any;

4> remove LTM-Config for LTM on the MCG, if any;

35       4> remove the ltm-CSI-ReportConfigToAddModList instances for all MCG Serving cells;

[...]

\*\*\*\*\*  
 \*\*\*\*\*

5

#### 5.3.5.4 Secondary cell group release

The UE shall:

- 1> as a result of SCG release triggered by E-UTRA (i.e. (NG)EN-DC case) or NR (i.e. NR-DC case):
  - 2> reset SCG MAC, if configured;
  - 10 2> for each RLC bearer that is part of the SCG configuration:
    - 3> perform RLC bearer release procedure as specified in 5.3.5.5.3;
  - 2> for each BH RLC channel that is part of the SCG configuration:
    - 3> perform BH RLC channel release procedure as specified in 5.3.5.5.10;
  - 2> release the SCG configuration;
  - 15 2> remove all the entries within the SCG *VarConditionalReconfig*, if any;
    - 2> remove all entries within the SCG *VarLTM-UE-Config*, if any;
    - 2> remove all entries within the SCG *VarLTM-Config*, if any;
    - 2> remove *LTM-Config* for LTM on the SCG, if any;
    - 2> remove the *ltn-CSI-ReportConfigToAddModList* instances for all SCG Serving cells;
  - 20 2> if SCG release was triggered by NR (i.e. NR-DC case):
    - 3> remove all the entries within the MCG *VarConditionalReconfig* for which the *RRCReconfiguration* within *condRRCReconfig* does not include the *masterCellGroup* with *reconfigurationWithSync*, if any;
  - 2> else (i.e. EN-DC case):
    - 25 3> perform *VarConditionalReconfiguration* CPC removal as specified in TS 36.331 [10] clause 5.3.5.9.7;
    - 2> stop timer T310 for the corresponding SpCell, if running;
    - 2> stop timer T312 for the corresponding SpCell, if running;
    - 2> stop timer T304 for the corresponding SpCell, if running.
  - 30 NOTE: Release of cell group means only release of the lower layer configuration of the cell group but the *RadioBearerConfig* may not be released.

\*\*\*\*\*  
 \*\*\*\*\*

35

- Another possibility to model this in RRC is to define a function for releasing LTM related configuration(s), as follows:

\*\*\*\*\*  
\*\*\*\*\*

### 5 5.3.5.x.y Release LTM related configuration

The UE shall:

- 1> as a result of the release of LTM related configurations;
- 2> remove all entries within the MCG *VarLTM-UE-Config*, if any;
- 2> remove all entries within the MCG *VarLTM-Config*, if any;
- 10 2> remove *LTM-Config* for LTM on the MCG, if any;
- 2> remove the *lrm-CSI-ReportConfigToAddModList* instances for all MCG Serving cells;

## 5.3.13 RRC connection resume

[...]

### 5.3.13.2 Initiation

15 [...]

Upon initiation of the procedure, the UE shall:

[...]

- 1> if the UE is in NE-DC or NR-DC:
  - 2> if the UE does not support maintaining SCG configuration upon connection resumption:
    - 20 3> release the MR-DC related configurations (i.e., as specified in 5.3.5.10) from the UE Inactive AS context, if stored;
  - 1> if the UE is configured with LTM related configuration(s):
    - 2> if the UE does not support maintaining LTM related configurations upon connection resumption:
      - 25 3> release the MCG LTM related configuration(s) (i.e., as specified in 5.3.5.x.y) from the UE Inactive AS context, if stored;
      - 3> release the SCG LTM related configuration(s) from the UE Inactive AS context, if stored;
      - 4> remove all entries within the SCG *VarLTM-UE-Config*, if any;
      - 4> remove all entries within the SCG *VarLTM-Config*, if any;
      - 4> remove *LTM-Config* for LTM on the SCG, if any;
      - 30 4> remove the *lrm-CSI-ReportConfigToAddModList* instances for all SCG Serving cells;

[...]

\*\*\*\*\*  
\*\*\*\*\*

35

In a set of embodiments, the UE releases the first set of LTM related configuration(s) in the

which were previously configured, by removing entries of one or more UE variables in which the first set of LTM related configuration(s) have been configured. This was shown in the example above, when the UE removes all entries within the MCG or SCG VarLTM-UE-Config, if any and when the UE removes all entries within the MCG or SCG VarLTM-Config, if any.

In one example, the UE stores LTM related information in two UE variables e.g. VarLTM-Config (used to store the reference configuration and the LTM candidate cell configurations) and VarLTM-UE-Config (used to store the generated UE configuration related to the received LTM candidate cell configurations).

10

#### **VarLTM-Config UE variable**

```

-- ASN1START
-- TAG-VarLTM-Config-START

VarLTM-Config-r18-IEs ::= SEQUENCE {
15   ltm-ReferenceConfiguration-r18      OCTET STRING (CONTAINING RRCReconfiguration),
   ltm-CandidateList-r18               LTM-CandidateList-r18
}

20   LTM-CandidateList-r18 ::= SEQUENCE (SIZE (1..maxNrofCellsLTM-r18)) OF LTM-Candidate-r18

-- TAG-VarLTM-Config-END
-- ASN1STOP

```

25

#### **VarLTM-UE-Config UE variable**

```

-- ASN1START
-- TAG-VarLTM-Config-START

VarLTM-UE-Config-r18-IEs ::= SEQUENCE {
30   ue-ltm-ConfigCandidateList-r18      UE-LTM-ConfigCandidateList-r18
}

UE-LTM-ConfigCandidateList-r18 ::= SEQUENCE (SIZE (1..maxNrofCellsLTM-r18)) OF UE-LTM-
35   Candidate-r18

UE-LTM-Candidate-r18 ::= SEQUENCE {
   ltm-CandidateId-r18                 LTM-CandidateId-r18,
   ue-LTM-Config-r18                  OCTET STRING (CONTAINING RRCReconfiguration)
40   }

-- TAG-VarLTM-Config-END
-- ASN1STOP

```

45

According to that example, removing the at least one LTM related configuration(s) upon resume initiation or during transition to RRC\_INACTIVE comprises:

- remove all entries within the *VarLTM-UE-Config*, if any;
- remove all entries within the *VarLTM-Config*, if any;

In a set of embodiments, the UE removes the first set of LTM related configuration(s) which

were previously configured, by removing the IE including the LTM related configuration (e.g. IE LTM-Config, and the IEs within) which is parts of its UE current configuration.

#### LTM-Config information element

```

5  -- ASN1START
   -- TAG LTM-CONFIG START

LTM-Config-r18 ::= SEQUENCE {
   ltm-ReferenceConfiguration-r18          OCTET STRING (CONTAINING RRCReconfiguration),
10  OPTIONAL, -- Cond FirstLTM-Candidate
   ltm-CandidateToReleaseList-r18         LTM-CandidateToReleaseList-r18
   OPTIONAL, -- Cond N
   ltm-CandidateToAddModList-r18         LTM-CandidateToAddModList-r18
   OPTIONAL, -- Cond N
15  ltm-ServingCellNoResetID-r18          INTEGER (1.. maxNrofCellsLTM-r18-plus-1)
   OPTIONAL, -- Cond FirstLTM-Only
   ltm-CSI-ResourceConfigToAddModList-r18 SEQUENCE (SIZE (1..maxNrofCSI-
   ResourceConfigurations)) OF LTM-CSI-ResourceConfig

20  OPTIONAL, -- Need N
   ltm-CSI-ResourceConfigToReleaseList-r18 SEQUENCE (SIZE (1..maxNrofCSI-
   ResourceConfigurations)) OF LTM-CSI-ResourceConfigId

   OPTIONAL, -- Need N
25  ...
}

Editor's Note: SFG on whether the LTM-CandidateNoResetID-List field should include separate
reset flags for RLC, and PDCP recovery.

30 LTM-CandidateToReleaseList-r18 ::= SEQUENCE (SIZE (1..maxNrofCellsLTM-r18)) OF LTM-
   CandidateId-r18
   OPTIONAL, -- Need N

   -- TAG LTM-CONFIG STOP
35 -- ASN1STOP

```

#### LTM-Config field descriptions

##### ***Ltm-CandidateToAddModList***

List of LTM candidate cell configurations to add and/or modify.

##### ***Ltm-CandidateToReleaseList***

List of LTM candidate cell configurations to remove.

##### ***Ltm-ServingCellNoResetID***

This field is used by the UE to determine on whether L2 reset should be performed for an LTM candidate cell upon an LTM cell switch procedure. If the value of *ltm-NoResetID* in an LTM candidate cell is the same as the value of *ltm-ServingCellNoResetID* in the serving cell of a cell group, then the UE shall not perform any L2 reset during the LTM cell switch procedure.

##### ***Ltm-ReferenceConfiguration***

This field includes an RRCReconfiguration message used to configure a reference configuration for LTM.

The first set of one or more LTM related configurations may correspond to one or more of the following (see further details in Section 2.7.1.2):

- 40     ○ i) Lower layer measurement configuration(s) for LTM;
- ii) Time Alignment acquisition (also called UL pre-sync configuration);
- iii) TCI state configuration(s) for pre-sync (also called DL pre-sync configuration);
- iv) LTM Reference configuration(s);
- v) LTM Candidate Cell Configuration (s);

- vi) Complete LTM candidate cell configuration(s) generated when the UE is configured with LTM
- vii) Other LTM related configuration(s)

5 In a set of embodiments, the UE which has deleted (removed/ released) the first set of LTM related configurations, initiates a resume procedure, transmits an RRC Resume Request message (e.g. RRCResumeRequest, or RRCResumeRequest1) and receives in response an RRC Resume message (RRCResume) including a second set of one or more LTM related configuration(s).

10 - In one option, the second set of one or more LTM related configuration(s) is comprised within the IE LTM-Config (shown above), as show below:

\*\*\*\*\*  
\*\*\*\*\*

```

15 RRCResume v18xy Ies ::= SEQUENCE {
    ltm-Config-r18          SetupRelease (LTM-Config-r18)
    OPTIONAL, -- Need M
    nonCriticalExtension    SEQUENCE {}
    OPTIONAL
20 }

```

### ***LTM-Config* information element**

```

25 -- ASN1START
-- TAG-LTM-CONFIG-START

LTM-Config-r18 ::= SEQUENCE {
    ltm-ReferenceConfiguration-r18    OCTET STRING (CONTAINING RRCReconfiguration),
    OPTIONAL, -- Cond FirstLTM-Candidate
    ltm-CandidateToReleaseList-r18    LTM-CandidateToReleaseList-r18
30    OPTIONAL, -- Need N
    ltm-CandidateToAddModList-r18     LTM-CandidateToAddModList-r18
    OPTIONAL, -- Cond N
    ltm-ServingCellNoResetID-r18      INTEGER (1.. maxNrofCellsLTM-r18-plus-1)
35    OPTIONAL, -- Cond FirstLTM-Only
    ltm-CSI-ResourceConfigToAddModList-r18 SEQUENCE (SIZE (1..maxNrofCSI-
    ResourceConfigurations)) OF LTM-CSI-ResourceConfig
    OPTIONAL, -- Need N
40    ltm-CSI-ResourceConfigToReleaseList-r18 SEQUENCE (SIZE (1..maxNrofCSI-
    ResourceConfigurations)) OF LTM-CSI-ResourceConfigId
    OPTIONAL, -- Need N
    ...
45 }

-- Editor's Note: PFS on whether the LTM-CandidateToReleaseList field should include separately
-- reset flags for ABF, and SDX recovery.

50 LTM-CandidateToReleaseList-r18 ::= SEQUENCE (SIZE (1..maxNrofCellsLTM-r18)) OF LTM-
    CandidateId-r18
    OPTIONAL -- Need N

-- TAG-LTM-CONFIG-END
55 -- ASN1STOP

```

| <i>LTM-Config field descriptions</i>     |                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>lrm-CandidateToAddModList</i></b>  | List of LTM candidate cell configurations to add and/or modify.                                                                                                                                                                                                                                                                                                                                |
| <b><i>lrm-CandidateToReleaseList</i></b> | List of LTM candidate cell configurations to remove.                                                                                                                                                                                                                                                                                                                                           |
| <b><i>lrm-ServingCellNoResetID</i></b>   | This field is used by the UE to determine on whether L2 reset should be performed for an LTM candidate cell upon an LTM cell switch procedure. If the value of <i>lrm-NoResetID</i> in an LTM candidate cell is the same as the value of <i>lrm-ServingCellNoResetID</i> in the serving cell of a cell group, then the UE shall not perform any L2 reset during the LTM cell switch procedure. |
| <b><i>lrm-ReferenceConfiguration</i></b> | This field includes an RRCReconfiguration message used to configure a reference configuration for LTM.                                                                                                                                                                                                                                                                                         |

\*\*\*\*\*  
\*\*\*\*\*

Below we show an example of a procedure text in RRC:

5 \*\*\*\*\*  
\*\*\*\*\*

#### 5.3.13.4 Reception of the RRCResume by the UE

The UE shall:

10           [...]

          1> if the *RRCResume* message includes the *lrm-Config*;

              2> if the *lrm-Config* is set as *setup*;

                  3> perform the LTM configuration procedure as specified in 5.3.5.x;

              2> else;

                  3> release the LTM configuration;

15           1> set the content of the *RRCResumeComplete* message as follows:

          [...]

\*\*\*\*\*  
\*\*\*\*\*

20 The second set of one or more LTM related configuration(s) may be the same or different than the first set of one or more LTM related parameters.

In a set of embodiments, a first network node operating as a Central Unit (CU) serving a UE (or serving CU), performs the following steps:

- Transmitting to the UE a first set of one or more LTM related configuration(s);

- 5           ○ In one option that first set of one or more LTM related configuration(s) is received in a message which corresponds to an RRC Reconfiguration message, which the UE may receive in different manners e.g. when it transitions to RRC\_CONNECTED (e.g. from RRC\_IDLE), or during a handover and/or during a reconfiguration with sync, or from the serving cell for intra-cell reconfiguration.
- In one option that first set of one or more LTM related configuration(s) is received when the UE is capable of handling one or more of the LTM related configuration(s). For example, the UE receives in the first set an UL pre-sync configuration(s) when the UE is capable of performing UL pre-sync for LTM.
- 10       - Transmitting a message to the network to suspend the connection and to transition the UE to Inactive state;

  - In one option that message from the network to suspend the connection and transitioning to Inactive state corresponds to an RRC Release message including a suspend configuration (suspendConfig).
  - 15           ○ In one sub-option that message from the first network node, e.g., CU-CP is transmitted to another network node, e.g., CU-UP, with one indication of suspending connection for the bearer(s) established for LTM operation, for example, in the E1AP BEARER CONTEXT MODIFICATION REQUEST message.
- 20       - Deleting (releasing/ discarding/ removing) the first set of one or more LTM related configurations in response to one or more of the following events:

  - Transmitting the message to the UE to transition the UE to Inactive state; or

    - 25           ▪ In one option, that message is included within a UE CONTEXT RELEASE COMMAND message (over F1AP signaling) which is transmitted to a Serving DU which forwards the RRCRelease message including the suspendConfig to the UE. In response to that, the Serving DU transmits to the first node a UE CONTEXT RELEASE COMPLETE message (over F1AP signaling). When that is received, the first network node (Serving CU, S-CU) transmits another UE CONTEXT RELEASE COMMAND, this time to one or more Candidate DU(s) associated to the first set of LTM related configuration(s), so the Candidate DU releases the first set of LTM configuration(s), and responds with a UE CONTEXT RELEASE COMPLETE. In

30           one sub-option, when the UE Context Release Command is received the S-DU releases the UE context in the S-DU and sends the UE Context Release complete and, when the UE tries to resume in the same S-DU, a UE CONTEXT SETUP procedure is needed. These steps are shown in the figure below:

35

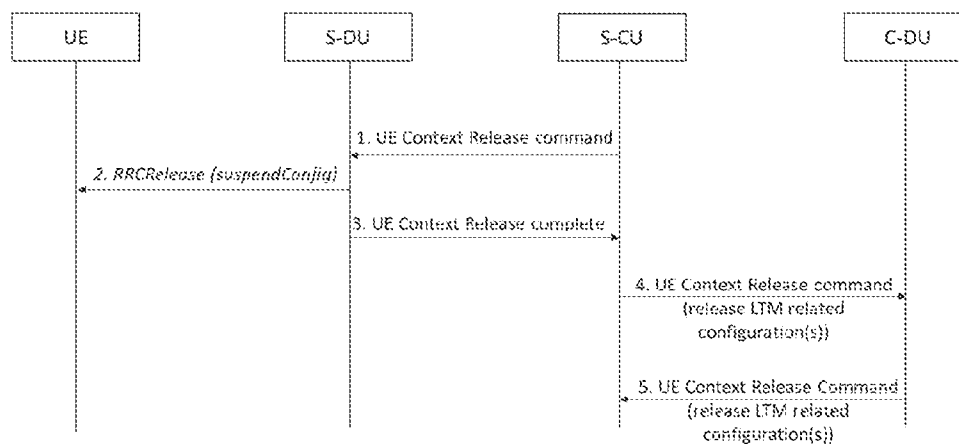


Figure 9 Release of LTM related configuration when the UE is suspended and the S-DU context is released

- 5                   ▪ In another option, that message is included within a UE CONTEXT MODIFICATION REQUEST message (over F1AP signaling) which includes an indication of suspension of lower layer and is transmitted to a Serving DU which forwards the RRCRelease message including the suspendConfig to the UE. In response to that, the Serving DU transmits to the first node a UE CONTEXT MODIFICATION RESPONSE message (over F1AP signaling). When that is received, the first network node (Serving CU, S-CU) transmits another UE CONTEXT RELEASE COMMAND, this time to one or more Candidate DU(s) associated to the first set of LTM related configuration(s), so the Candidate DU releases the first set of LTM configuration(s), and responds with a UE CONTEXT RELEASE COMPLETE. In one sub-option, when the UE CONTEXT MODIFICATION REQUEST message (over F1AP signaling) which includes an indication of suspension of lower layer is received the S-DU keeps all lower layer configuration for the UE, and does not transmit or receive data from the UE. , If later the UE tries to resume in the same S-DU, a UE CONTEXT MODIFICATION REQUEST message, is sent with the Lower Layer presence status change IE set to "resume lower layers" and as a result the gNB-DU shall use the previously stored lower layer configuration for the UE.
- 10                   ○ During an initiation of a resume procedure.
- 15                   ▪ In one option, when the CU receives an RRC Resume Request, it knows that the UE is releasing the first set of LTM related configurations and, in response to that, the first network node (Serving CU, S-CU) transmits a UE CONTEXT RELEASE COMMAND to one or more Candidate DU(s) associated to the first set of LTM related configuration(s), so the Candidate DU releases the first set of LTM configuration(s), and responds with a UE CONTEXT RELEASE COMPLETE.
- 20                   ○ During an initiation of a resume procedure.
- 25                   ▪ In one option, when the CU receives an RRC Resume Request, it knows that the UE is releasing the first set of LTM related configurations and, in response to that, the first network node (Serving CU, S-CU) transmits a UE CONTEXT RELEASE COMMAND to one or more Candidate DU(s) associated to the first set of LTM related configuration(s), so the Candidate DU releases the first set of LTM configuration(s), and responds with a UE CONTEXT RELEASE COMPLETE.
- 30                   ○ During an initiation of a resume procedure.

- In one sub-option, when the UE context in the S-DU has been suspended instead of released, the S-DU sends a UE CONTEXT MODIFICATION REQUEST for resuming the UE context, before it sends the RRC Resume message to the UE.
- 5     ▪ In one sub-option the CU-CP sends to another network node, e.g., CU-UP, with one indication of resuming connection for the bearer(s) established for LTM operation, for example, in the E1AP BEARER CONTEXT MODIFICATION RESPONSE message.
- These steps are shown below:

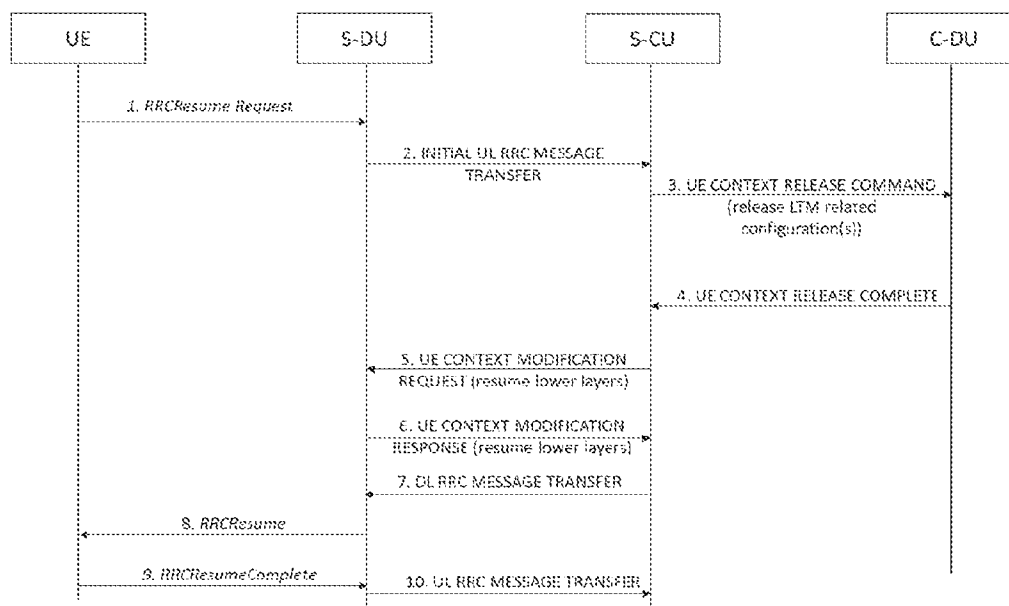


Figure 10 Release of LTM related configurations when the UE tries to resume

In a set of embodiments, the first network node (e.g. Serving CU) receives from the UE an RRC Resume Request message (e.g. RRCResumeRequest or RRCResumeRequest1 message) and determines to configure the UE with a second set of LTM related configuration. Before that, the first network node requests at least one Candidate DU to configure LTM to the incoming UE, for example, by transmitting a UE CONTEXT SETUP REQUEST; in response to which, the first network node receives from the Candidate DU a UE CONTEXT SETUP RESPONSE including at least one configuration from the second set of the one more LTM related configurations e.g. configuration per LTM candidate cell, UL pre-sync configuration, DL pre-sync configuration, other LTM related configuration. Then, the first network node includes the second set of LTM related configuration(s) in an RRC Resume message to be transmitted to the UE. Therefore, even in the case where the UE stores the first LTM configuration when suspended, the network may update the LTM configuration with a second LTM configuration in the RRC Resume message. An example is shown in the following figure:

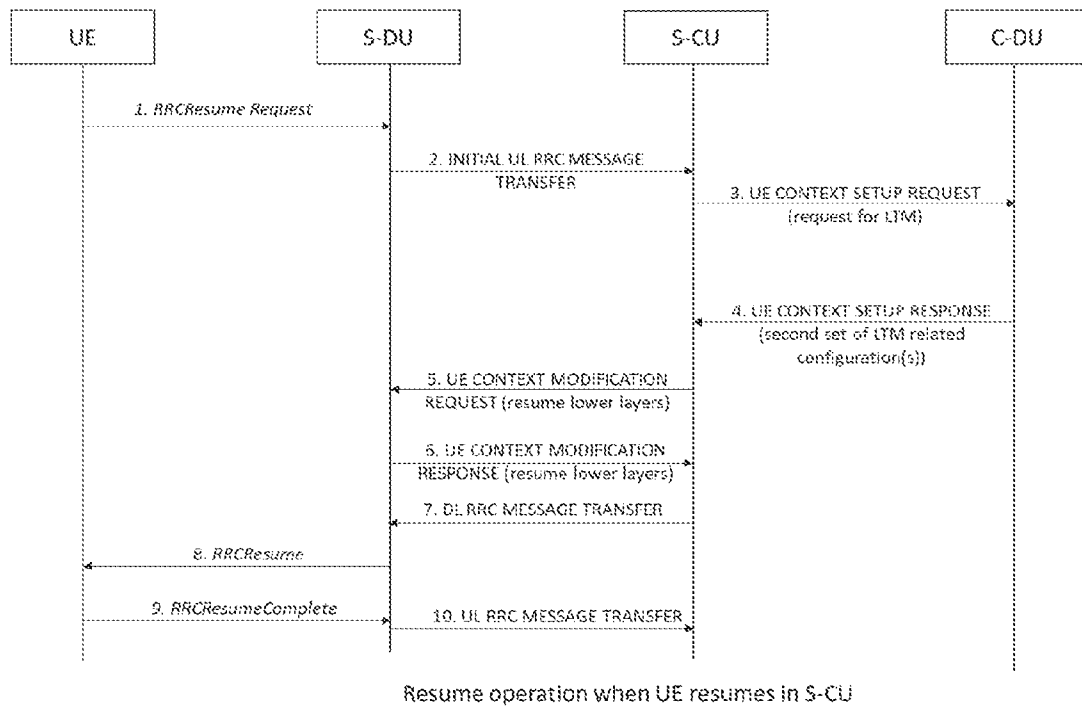


**Figure 11 Including second set of LTM related configurations in RRC Resume**

In a set of embodiments performed by a UE, the UE performs the following actions:

- 5     - Receiving a first set of one or more LTM related configuration(s);
  - In one option that first set of one or more LTM related configuration(s) is received in a message which corresponds to an RRC Reconfiguration message, which the UE may receive in different manners e.g. when it transition to RRC\_CONNECTED (e.g. from RRC\_IDLE), or during a handover and/or during a reconfiguration with sync,
  - 10    ○ In one option that first set of one or more LTM related configuration(s) is received when the UE is capable of handling one or more of the LTM related configuration(s). For example, the UE receives in the first set an UL pre-sync configuration(s) when the UE is capable of performing UL pre-sync for LTM.
- 15    - Receiving a message from the network to suspend the connection and transitioning to Inactive state e.g. RRC\_INACTIVE;
  - In one option that message from the network to suspend the connection and transitioning to Inactive state corresponds to an RRC Release message including a suspend configuration (suspendConfig).
- 20    - Storing the first set of one or more LTM related configurations in response to receiving the message from the network to suspend the connection.
  - In one option, this is modeled as follows in the RRC specifications:

\*\*\*\*\*  
\*\*\*\*\*

### 5.3.8.3 Reception of the RRCRelease by the UE

The UE shall:

- 5        [...]
- 1> if the *RRCRelease* includes *suspendConfig*:
  - [...]
  - 2> if the *RRCRelease* message with *suspendConfig* was received in response to an *RRCResumeRequest* or an *RRCResumeRequest1*:
    - 10        [...]
    - 2> else:
      - 3> store in the UE Inactive AS Context the *nextHopChainingCount* received in the *RRCRelease* message, the current  $K_{gNB}$  and  $K_{RRCint}$  keys, the ROHC state, the EHC context(s), the stored QoS flow to DRB mapping rules, the C-RNTI used in the source PCell, the *cellIdentity* and the physical cell identity of the source PCell, the *spCellConfigCommon* within *ReconfigurationWithSync* of the NR PSCell (if configured) and all other parameters (including LTM related parameters) configured except for:
        - parameters within *ReconfigurationWithSync* of the PCell;
        - parameters within *ReconfigurationWithSync* of the NR PSCell, if configured;
        - 20        - parameters within *MobilityControlInfoSCG* of the E-UTRA PSCell, if configured;
        - *servingCellConfigCommonSIB*;
- NOTE: The LTM related parameters include all entries within the MCG and SCG VarLTM-UE-Config, entries within the MCG and SCG VarLTM-Config, the IE LTM-Config, and the ltm-CSI-ReportConfigToAddModList instances for all Serving cells.
- 25        [...]
- 2> enter RRC\_INACTIVE and perform cell selection as specified in TS 38.304 [20];
- 1> else
  - 2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with the release cause 'other'.

\*\*\*\*\*  
\*\*\*\*\*

In a set of embodiments, the UE stores the first set of LTM related configuration(s) in the which were previously configured, by storing entries of one or more UE variables in which the first set of LTM related configuration(s) have been configured. This was shown in the example above.

In one example, the UE stores LTM related information in two UE variables e.g. VarLTM-Config (used to store the reference configuration and the LTM candidate cell configurations) and VarLTM-UE-Config (used to store the generated UE configuration related to the received LTM candidate cell configurations).

5

**VarLTM-Config UE variable**

```

-- ASN1START
-- TAG-VarLTM-Config-START

VarLTM-Config-r18-IEs ::= SEQUENCE {
10   ltm-ReferenceConfiguration-r18    OCTET STRING (CONTAINING RRCReconfiguration),
   ltm-CandidateList-r18             LTM-CandidateList-r18
}

15   LTM-CandidateList-r18 ::= SEQUENCE (SIZE (1..maxNrofCellsLTM-r18)) OF LTM-Candidate-r18

-- TAG-VarLTM-Config-END
-- ASN1STOP

```

20

**VarLTM-UE-Config UE variable**

```

-- ASN1START
-- TAG-VarLTM-Config-START

VarLTM-UE-Config-r18-IEs ::= SEQUENCE {
25   ue-ltm-ConfigCandidateList-r18    UE-LTM-ConfigCandidateList-r18
}

UE-LTM-ConfigCandidateList-r18 ::= SEQUENCE (SIZE (1..maxNrofCellsLTM-r18)) OF UE-LTM-
Candidate-r18

30   UE-LTM-Candidate-r18 ::= SEQUENCE {
   ltm-CandidateId-r18                LTM-CandidateId-r18,
   ue-LTM-Config-r18                 OCTET STRING (CONTAINING RRCReconfiguration)
}

35   -- TAG-VarLTM-Config-END
-- ASN1STOP

```

In a set of embodiments, the UE stores the first set of LTM related configuration(s) which were previously configured, by storing the IE including the LTM related configuration (e.g. IE LTM-Config, and the IEs within) which is parts of its UE current configuration.

40

**LTM-Config information element**

```

-- ASN1START
-- TAG-LTM-Config-START

45   LTM-Config-r18 ::= SEQUENCE {
   ltm-ReferenceConfiguration-r18    OCTET STRING (CONTAINING RRCReconfiguration),
OPTIONAL, -- Cond FirstLTM-Candidate
   ltm-CandidateToReleaseList-r18    LTM-CandidateToReleaseList-r18
50   OPTIONAL, -- Cond N
   ltm-CandidateToAddModList-r18     LTM-CandidateToAddModList-r18
OPTIONAL, -- Cond N
   ltm-ServingCellNoResetID-r18      INTEGER (1.. maxNrofCellsLTM-r18-plus-1)
OPTIONAL, -- Cond FirstLTM-Only
55   ltm-CSI-ResourceConfigToAddModList-r18 SEQUENCE (SIZE (1..maxNrofCSI-
ResourceConfigurations)) OF LTM-CSI-ResourceConfig

```

```

OPTIONAL, -- Need N
    ltm-CST-ResourceConfigToReleaseList-r18      SEQUENCE (SIZE (1..maxNrofCST-
ResourceConfigurations)) OF LTM-CST-ResourceConfigId
5
OPTIONAL, -- Need N
    ...
}

Editor's Note: SEE if whether the LTM-CandidateNoResetIDList field should include separate
10 reset flags for RLC, and PDCP recovery.

LTM-CandidateToReleaseList-r18 ::= SEQUENCE (SIZE (1..maxNrofCellsLTM-r18)) OF LTM-
CandidateId-r18
15
OPTIONAL, -- Need N

-- TAG-LTM-CONFIG-STOP
-- END-LTM-CONFIG-STOP

```

| <i>LTM-Config field descriptions</i>     |                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Ltm-CandidateToAddModList</i></b>  | List of LTM candidate cell configurations to add and/or modify.                                                                                                                                                                                                                                                                                                                                |
| <b><i>Ltm-CandidateToReleaseList</i></b> | List of LTM candidate cell configurations to remove.                                                                                                                                                                                                                                                                                                                                           |
| <b><i>Ltm-ServingCellNoResetID</i></b>   | This field is used by the UE to determine on whether L2 reset should be performed for an LTM candidate cell upon an LTM cell switch procedure. If the value of <i>Ltm-NoResetID</i> in an LTM candidate cell is the same as the value of <i>Ltm-ServingCellNoResetID</i> in the serving cell of a cell group, then the UE shall not perform any L2 reset during the LTM cell switch procedure. |
| <b><i>Ltm-ReferenceConfiguration</i></b> | This field includes an RRCReconfiguration message used to configure a reference configuration for LTM.                                                                                                                                                                                                                                                                                         |

20

In a set of embodiments, the UE stores the first set of LTM related configuration(s) separately for the MCG and the SCG.

The first set of one or more LTM related configurations may correspond to one or more of the following (see further details in Section 2.7.1.2):

- 25
- i) Lower layer measurement configuration(s) for LTM;
  - ii) Time Alignment acquisition (also called UL pre-sync configuration);
  - iii) TCI state configuration(s) for pre-sync (also called DL pre-sync configuration);
  - iv) Reference configuration(s);
  - v) Complete LTM candidate configuration(s) generated when the UE is configured
  - 30 with LTM
  - vi) Other LTM related configuration(s)

In a set of embodiments, the UE initiates a resume procedure, transmits an RRC Resume Request message and receives an RRC Resume message including a first indication (e.g., *restoreLTM* field) and, in response to the first indication, the UE restores the first set of stored LTM related configuration(s). Otherwise, upon determining that the first indication is absent, the UE releases (deletes/ removes) the first set of LTM related configuration(s). One advantage of such approach is that when the target network node in which the UE is trying to resume is not LTM capable, the first indication would not be included in the RRC Resume message so that the UE releases LTM related configurations. And, in case the target network node in which the UE is trying to resume is LTM capable, the target network node can decide to either include the first indication in the RRC Resume message indicating the UE to release the LTM related configurations, or not include the first indication in the RRC Resume message (to indicate the UE to restore the LTM related configurations).

In this set of embodiments, the UE may restore the first set of stored LTM related configuration(s) for the MCG as response to the first indication and restore the first set of stored LTM related configuration(s) for the SCG as response to another indication, for example a *restoreSCG* indication. In one example, the UE may restore the first set of stored LTM related configuration(s) for the SCG according to the first indication and another indication, such as a *restoreSCG* indication. For example, the UE restores the first set of stored LTM related configuration(s) for the SCG when both the first indication and the *restoreSCG* indication are present.

Below we show an example of how this may be specified in the RRC specifications:

\*\*\*\*\*  
\*\*\*\*\*

#### 5.3.13.4 Reception of the *RRCResume* by the UE

The UE shall:

[...]

1> if the *RRCResume* includes the *fullConfig*:

2> perform the full configuration procedure as specified in 5.3.5.11;

1> else:

[...]

2> if the *RRCResume* does not include the *restoreSCG*:

3> release the MR-DC related configurations (i.e., as specified in 5.3.5.10) from the UE Inactive AS context, if stored;

2> if the *RRCResume* does not include the *restoreLTM*:

3> release the LTM related configurations (i.e., as specified in 5.3.5.x) from the UE Inactive AS context, if stored;

*Editor's Note: FFS define the procedure for releasing LTM related configuration 5.3.5.x when IE's and LI parameters are stable.*

2> restore the *masterCellGroup*, *mrdc-SecondaryCellGroup*, if stored, LTM related configurations, if stored, and *pdcp-Config* from the UE Inactive AS context;

[...]

1> discard the UE Inactive AS context;

[...]

### 5.3.5.10 MR-DC release

The UE shall:

- 1> as a result of MR-DC release triggered by E-UTRA or NR:
  - 2> release SRB3, if established, as specified in 5.3.5.6.2;
  - 2> release *measConfig* associated with SCG;
  - 2> if the UE is configured with NR SCG:
    - 3> release the SCG configuration as specified in clause 5.3.5.4;
    - 3> release *otherConfig* associated with the SCG, if configured;
    - 3> stop timers T346a, T346b, T346c, T346d, T346e, T346j and T346k associated with the SCG, if running;
    - 3> release *bap-Config* associated with the SCG, if configured;
    - 3> release the BAP entity as specified in TS 38.340 [47], if there is no configured *bap-Config*;
    - 3> release *iab-IP-AddressConfigurationList* associated with the SCG, if configured;
  - 2> else if the UE is configured with E-UTRA SCG:
    - 3> release the SCG configuration as specified in TS 36.331 [10], clause 5.3.10.19 to release the E-UTRA SCG;

[...]

### 5.3.5.4 Secondary cell group release

The UE shall:

- 1> as a result of SCG release triggered by E-UTRA (i.e. (NG)EN-DC case) or NR (i.e. NR-DC case):
  - 2> reset SCG MAC, if configured;
  - 2> for each RLC bearer that is part of the SCG configuration:
    - 3> perform RLC bearer release procedure as specified in 5.3.5.5.3;
  - 2> for each BH RLC channel that is part of the SCG configuration:
    - 3> perform BH RLC channel release procedure as specified in 5.3.5.5.10;
  - 2> release the SCG configuration;
  - 2> remove all the entries within the SCG *VarConditionalReconfig*, if any;
  - 2> remove all entries within the SCG *VarLTM-UE-Config*, if any;
  - 2> remove all entries within the SCG *VarLTM-Config*, if any;
  - 2> remove *LTM-Config* for LTM on the SCG, if any;
  - 2> remove the *ltn-CSI-ReportConfigToAddModList* instances for all SCG Serving cells;
  - 2> if SCG release was triggered by NR (i.e. NR-DC case):
    - 3> remove all the entries within the MCG *VarConditionalReconfig* for which the *RRCReconfiguration* within *condRRCReconfig* does not include the *masterCellGroup* with *reconfigurationWithSync*, if any;

2> else (i.e. EN-DC case):

3> perform *VarConditionalReconfiguration* CPC removal as specified in TS 36.331 [10] clause 5.3.5.9.7;

2> stop timer T310 for the corresponding SpCell, if running;

5 2> stop timer T312 for the corresponding SpCell, if running;

2> stop timer T304 for the corresponding SpCell, if running.

NOTE: Release of cell group means only release of the lower layer configuration of the cell group but the *RadioBearerConfig* may not be released.

[...]

```

10 RRCResume-v18xv-Tes ::= SEQUENCE {
    restoreLTM-r18 ENUMERATED {true}
    OPTIONAL, -- Need N
    nonCriticalExtension SEQUENCE {}
15 OPTIONAL
}

restoreLTM
Indicates that the UE shall restore the LTM related configurations from the UE Inactive AS
20 Context, if stored.

```

\*\*\*\*\*

25 In a set of embodiments, the UE which has stored the first set of LTM related configurations when it was suspended, initiates a resume procedure, transmits an RRC Resume Request message (e.g. RRCResumeRequest, or RRCResumeRequest1) and receives in response an RRC Resume message (RRCResume) including a second set of one or more LTM related configuration(s). As the previous set of embodiments indicate, either the UE has deleted (removed/ released) the first set of LTM related configurations (when the first indication e.g. restoreLTM is absent in the RRC Resume message) or restored the first set of LTM related configurations (when the first indication e.g. restoreLTM is absent in the RRC Resume message).

- In one option, the second set of one or more LTM related configuration(s) is comprised within the IE LTM-Config (shown above), as show below:

```

35 *****
*****

RRCResume-v18xv-Tes ::= SEQUENCE {
40   ltm-Config-r18 SetupRelease {LTM-Config-r18}
    OPTIONAL, -- Need N
    nonCriticalExtension SEQUENCE {}
    OPTIONAL
}

45 [...]

```

LTM-Config information element

```

-- ASN1START
-- TAG LTM-CONFIG-START
5
LTM-Config-r18 ::= SEQUENCE {
    ltm-ReferenceConfiguration-r18    OCTET STRING (CONTAINING RRCReconfiguration),
OPTIONAL, -- Cond FirstLTM-Candidate
    ltm-CandidateToReleaseList-r18    LTM-CandidateToReleaseList-r18
10
OPTIONAL, -- Cond N
    ltm-CandidateToAddModList-r18     LTM-CandidateToAddModList-r18
OPTIONAL, -- Cond N
    ltm-ServingCellNoResetID-r18      INTEGER (1.. maxNrofCellsLTM-r18-plus-1)
OPTIONAL, -- Cond FirstLTM Only
15
    ltm-CSI-ResourceConfigToAddModList-r18 SEQUENCE (SIZE (1..maxNrofCSI-
ResourceConfigurations)) OF LTM-CSI-ResourceConfig
OPTIONAL, -- Need N
    ltm-CSI-ResourceConfigToReleaseList-r18 SEQUENCE (SIZE (1..maxNrofCSI-
20
ResourceConfigurations)) OF LTM-CSI-ResourceConfigId
OPTIONAL, -- Need N
    ...
25
}

Editor's Note: PPA on whether the LTM-CandidateNoResetID-List field should include separate
reset flags for ALC, and SDAP recovery.

LTM-CandidateToReleaseList-r18 ::= SEQUENCE (SIZE (1..maxNrofCellsLTM-r18)) OF LTM-
30
CandidateId-r18
OPTIONAL, -- Cond N

-- TAG LTM-CONFIG-END
-- ASN1END
35
```

| LTM-Config field descriptions            |                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Ltm-CandidateToAddModList</i></b>  | List of LTM candidate cell configurations to add and/or modify.                                                                                                                                                                                                                                                                                                                                |
| <b><i>Ltm-CandidateToReleaseList</i></b> | List of LTM candidate cell configurations to remove.                                                                                                                                                                                                                                                                                                                                           |
| <b><i>Ltm-ServingCellNoResetID</i></b>   | This field is used by the UE to determine on whether L2 reset should be performed for an LTM candidate cell upon an LTM cell switch procedure. If the value of <i>Ltm-NoResetID</i> in an LTM candidate cell is the same as the value of <i>Ltm-ServingCellNoResetID</i> in the serving cell of a cell group, then the UE shall not perform any L2 reset during the LTM cell switch procedure. |
| <b><i>Ltm-ReferenceConfiguration</i></b> | This field includes an RRCReconfiguration message used to configure a reference configuration for LTM.                                                                                                                                                                                                                                                                                         |

\*\*\*\*\*  
\*\*\*\*\*

Below we show an example of a procedure text in RRC:

\*\*\*\*\*  
\*\*\*\*\*

5.3.13.4 Reception of the RRCResume by the UE

The UE shall:

[...]

1> if the *RRCResume* message includes the *ltn-Config*:

2> if the *ltn-Config* is set as *setup*:

3> perform the LTM configuration procedure as specified in 5.3.5.x;

5 2> else:

3> release the LTM configuration;

1> set the content of the *RRCResumeComplete* message as follows:

[...]

\*\*\*\*\*  
10 \*\*\*\*\*

The second set of one or more LTM related configuration(s) may be the same or different than the first set of one or more LTM related parameters.

15 In the following some network related embodiments are disclosed. The fact that the UE suspends the LTM related configurations may not imply that LTM related configurations are also suspended on all nodes at the network side. It is possible, for example, that the network implementation (e.g. in the first network node) releases LTM related configurations at the Candidate DU, while it actually stores both the higher layer and lower layer context in the first network node, in the UE Inactive AS Context, also stored at the UE side. In other words, the second method comprises both alternatives:

- 1. UE is suspended and stores LTM related configurations, while the S-CU stores LTM related configurations, but releases LTM related configuration(s) from the Candidate DU (so context setup is triggered in resume operation).
- 25 - 2. UE is suspended and stores LTM related configurations, while the S-CU stores LTM related configurations, and suspends LTM related configuration(s) from the Candidate DU (so context modification is triggered in resume operation).

In the following, the focus is on case 2., in which the UE is suspended and stores LTM related configurations, while the S-CU stores LTM related configurations, and suspends LTM related configuration(s) from the Candidate DU (so context modification is triggered in resume operation).

In a set of embodiments, a first network node operating as a Central Unit (CU) serving a UE (or serving CU), performs the following steps:

- Transmitting to the UE a first set of one or more LTM related configuration(s);
  - In one option that first set of one or more LTM related configuration(s) is received in a message which corresponds to an RRC Reconfiguration message, which the UE may receive in different manners e.g. when it transitions to RRC\_CONNECTED (e.g. from RRC\_IDLE), or during a handover and/or during a reconfiguration with sync, or from the serving cell for intra-cell reconfiguration.
  - In one option that first set of one or more LTM related configuration(s) is received when the UE is capable of handling one or more of the LTM related configuration(s). For example, the UE receives in the first set an UL pre-sync configuration(s) when the UE is capable of performing UL pre-sync for LTM.
- Transmitting a message to the UE network to suspend the connection and to transition the UE to Inactive state;
  - In one option that message from the network to suspend the connection and transitioning to Inactive state corresponds to an RRC Release message including a suspend configuration (suspendConfig).
  - In one sub-option that message from the first network node, e.g., CU-CP is transmitted to another network node, e.g., CU-UP, with one indication of suspending connection for the bearer(s) established for LTM operation, for example, in the E1AP BEARER CONTEXT MODIFICATION REQUEST message.
  - In one option, that message is included within a UE CONTEXT RELEASE COMMAND message (over F1AP signaling) which is transmitted to a Serving DU which forwards the RRCRelease message including the suspendConfig to the UE. In response to that, the Serving DU transmits to the first node a UE CONTEXT RELEASE COMPLETE message (over F1AP signaling).
  - In one option, that message is included within a UE CONTEXT MODIFICATION REQUEST message (over F1AP signaling) including an indication for suspension of the lower layers, an example being the *Lower Layer presence status change* IE is set to "suspend lower layers". The RRC Release with suspendConfig is transmitted to a Serving DU which forwards the RRCRelease message including the suspendConfig to the UE. In response to that, the Serving DU transmits to the first node a UE CONTEXT MODIFICATION RESPONSE message (over F1AP signaling).
- Storing the first set of one or more LTM related configurations in response to transmitting the message to the UE to transition the UE to Inactive state.
  - When the first network node stores the LTM related configurations e.g. in the UE Inactive context at the network side, the first network node (Serving CU, S-CU) transmits a UE CONTEXT MODIFICATION REQUEST to one or more Candidate DU(s) associated to the first set of LTM related configuration(s) including an indication for suspension of lower layers, so the Candidate DU suspends the first set of LTM configuration(s), and responds with a UE CONTEXT MODIFICATION RESPONSE. When LTM related configuration(s) are suspended at the C-DU, these are stored and not discarded. One example of these steps is shown in the figure below:

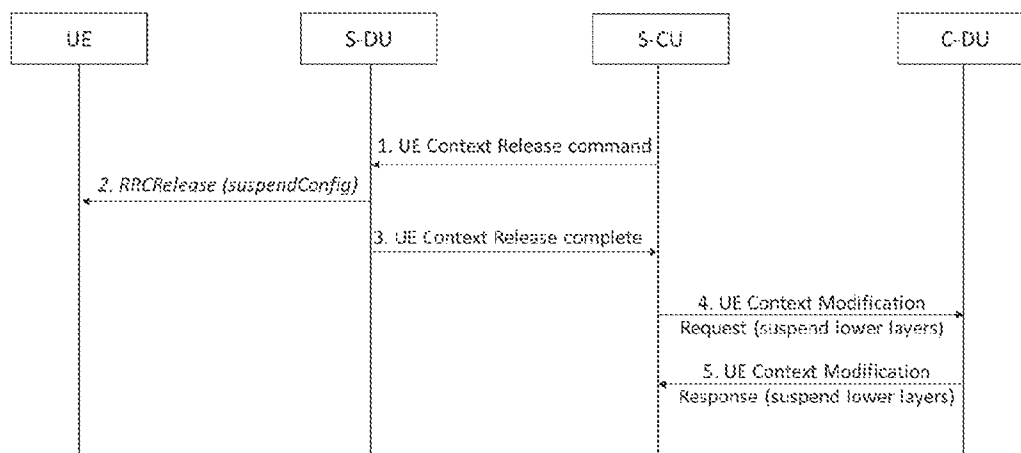


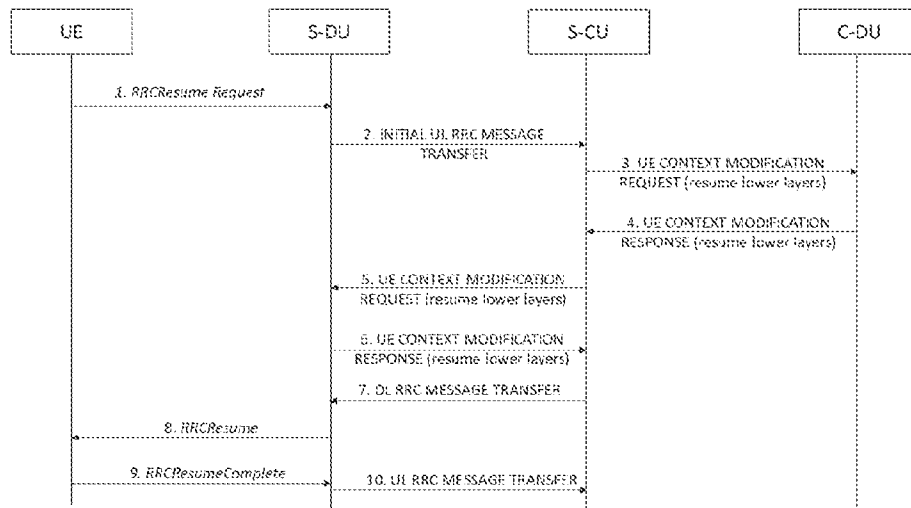
Figure 12 S-CU suspending the LTM related configurations towards the C-DU

[0034] In a set of embodiments, the first network node (e.g. Serving CU) receives from the UE an RRC Resume Request message (e.g. RRCResumeRequest or RRCResumeRequest1 message) and determines to either indicate to the UE to restore the first set of LTM related configuration(s), by including the first indication in the RRC Resume message (e.g. restoreLTM) or to indicate to the UE to delete (remove/ release) the first set of LTM related configuration(s), by not including the first indication.

[0035] When the first network node determines to delete the first set of LTM related configuration(s), the first network node transmits a message to one or more Candidate DU(s) associated to the first set of LTM related configuration(s) for deleting the first set of LTM related configuration(s) e.g. by transmitting an UE CONTEXT RELEASE COMMAND to the one or more Candidate DU(s), in response to which the Candidate DU(s) would release the first set of LTM related configuration(s) or parts of it. The case in which a Candidate DU releases part of the first set of LTM related configuration(s) is when the first set of LTM related configuration(s) relates to multiple candidate DU(s), so that each Candidate DU deletes its associated LTM related configuration(s), part of the first set of LTM related configuration(s).

[0036] When the first network node determines to restore the first set of LTM related configuration(s), the first network node transmits a message to one or more Candidate DU(s) associated to the first set of LTM related configuration(s) for resuming the first set of LTM related configuration(s) e.g. by transmitting an UE CONTEXT MODIFICATION REQUEST to the one or more Candidate DU(s) including an indication for resuming the one first set of LTM related configuration(s), in response to which the Candidate DU(s) resumes the first set of LTM related configuration(s) or parts of it. For the S-CU to be able to resume LTM related

configuration(s) at C-DU(s), the context information (e.g. UE Inactive AS Context) needs to include information about the C-DU e.g. node identifiers, FIAP signaling association(s), tunnel identifiers, etc. One example is shown in the figure below:



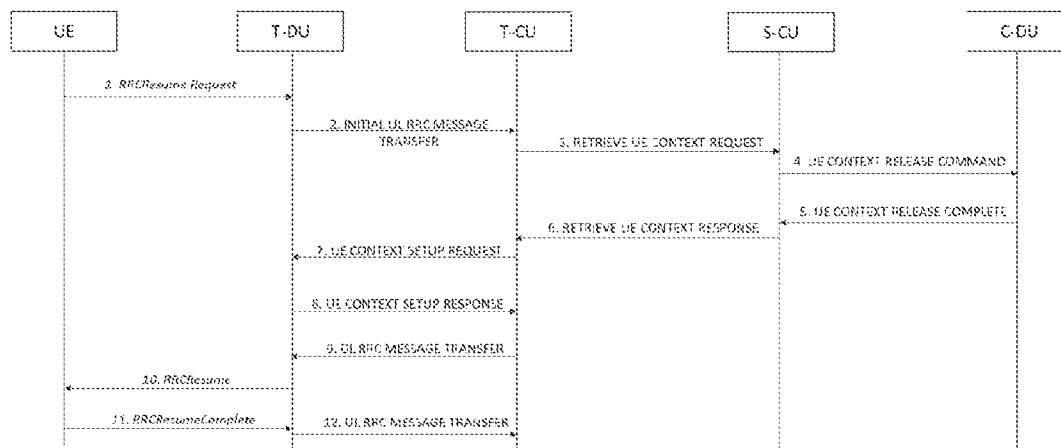
5

Figure 13 Resume of LTM related configuration(s)

[0037] In a set of embodiments, the first network node (e.g. Serving CU) receives from the UE an RRC Resume Request message (e.g. RRCResumeRequest or RRCResumeRequest1 message) and configures the UE with a second set of LTM related configuration. That may be configured on top of the first set of LTM related configuration(s), in case the first network node indicated the UE to restore the first set of LTM related configuration(s), or not (in case the first network node indicated the UE to delete the first set of LTM related configuration(s), or a full configuration indication is included). In one option, before transmitting the RRC Resume message to the UE, including the second set of LTM related configuration(s), the first network node requests at least one Candidate DU to configure LTM to the incoming UE, for example, by transmitting a UE CONTEXT SETUP REQUEST; in response to which, the first network node receives from the Candidate DU a UE CONTEXT SETUP RESPONSE including at least one configuration from the second set of the one more LTM related configurations e.g. configuration per LTM candidate cell, UL pre-sync configuration, DL pre-sync configuration, other LTM related configuration. Then, the first network node includes the second set of LTM related configuration(s) in an RRC Resume message to be transmitted to the UE. In one sub-option the CU-CP sends to another network node, e.g., CU-UP, with one indication of resuming connection for the bearer(s) established for LTM operation, for example, in the FIAP BEARER CONTEXT MODIFICATION RESPONSE message.

20

[0038] In a set of embodiments, the first network node which has suspended the UE with the first set of LTM related configuration(s), also called last serving network node, receives a message requesting UE Context from a second network node (e.g. XnAP: RETRIEVE UE  
 5 CONTEXT REQUEST), in response to which the first network node deletes the first set of LTM related configuration(s) from a UE Inactive AS Context, and responds the second network node with a UE Context response message (e.g. XnAP: RETRIEVE UE CONTEXT RESPONSE), including the UE Inactive AS Context (without the first set of LTM related configuration(s)). As part of that, the first network node also deletes the first set of LTM related  
 10 configuration(s) towards one or more C-DU(s) associated to the first set of LTM related configuration(s) e.g. by transmitting a UE CONTEXT RELEASE COMMAND to the one or more C-DU(s) (in response to which it receives a UE CONTEXT RELEASE COMPLETE). An example is shown below:



15 Figure 14 S-CU deleting LTM related configuration(s) upon UE context being requested by another gNodeB

[0039] One advantage of the following steps at the first network node shown above is that the first set of LTM related configuration(s) is stored at the first network node for the case the  
 20 UE may resume in the same cell or in a cell associated to the same node / CU, as LTM may be only valid for the same CU, as it is the case for Rel-18 UE(s) or UE(s) with a capability only for intra-CU LTM. However, in case the UE is suspended with the first set of LTM related configuration(s) stored, moves around with cell reselection and tries to resume in a cell which is associated to a target gNodeB with a target CU (different from the Source CU), the target  
 25 CU requests the UE context to the last serving gNodeB (i.e. to the S-CU) and, that S-CU,

knowing that the target CU would not benefit from the LTM related configuration(s) since inter-CU LTM would not be supported in by the UE, releases the first set of LTM related configuration(s) from the UE Inactive AS Context before providing the context to the target CU (and also releases the first set of LTM related configuration(s) from one or more Candidate DU(s)).

[0040] Notice that another benefit is that it addresses the scenario in which the target CU is not even LTM capable. In that case, the target CU does not receive any LTM related configuration in the UE Inactive AS context from the S-CU.

#### Proposed text for TS 38.473

### 8.3.4 UE Context Modification (gNB-CU initiated)

#### 8.3.4.1 General

The purpose of the UE Context Modification procedure is to modify the established UE Context, e.g., establishing, modifying and releasing radio resources or sidelink resources.

This procedure is also used to command the gNB-DU to stop data transmission for the UE for mobility (see TS 38.401 [4]). The procedure uses UE-associated signaling.

~~Omit text~~

If the *LTM presence status change* IE set to "suspend LTM" is included in the UE CONTEXT MODIFICATION REQUEST, the gNB-DU shall keep all lower layer including LTM configuration for UEs, and not transmit or receive data from UE.

If the *LTM presence status change* IE set to "resume LTM" is included in the UE CONTEXT MODIFICATION REQUEST message, the gNB-DU shall use the previously stored lower layer including LTM configuration for the UE.

~~Omit text~~

### 9.2.2.7 UE CONTEXT MODIFICATION REQUEST

This message is sent by the gNB-CU to provide UE Context information changes to the gNB-DU.

Direction: gNB-CU → gNB-DU

| IE/Group Name              | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|----------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type               | M        |       | 9.3.1.1               |                       | YES         | reject               |
| gNB-CU UE F1AP ID          | M        |       | 9.3.1.4               |                       | YES         | reject               |
| gNB-DU UE F1AP ID          | M        |       | 9.3.1.5               |                       | YES         | reject               |
| <del>Omit rows</del>       |          |       |                       |                       |             |                      |
| LTM Presence Status Change | O        |       | 9.3.1.x               |                       | Yes         | ignore               |

Omit text

## 9.3.1.x LTM Presence Status Change

- 5 This IE indicates lower layer including LTM configuration presence status shall be changed.

| IE/Group Name              | Presence | Range | IE type and reference                    | Semantics description                                                                                                                                                      |
|----------------------------|----------|-------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LTM Presence Status Change | M        |       | ENUMERATED (suspend LTM, resume LTM ...) | "suspend LTM" will store LTM related configurations(s). "resume LTM" shall restore LTM related configuration(s) and it is set only after "suspend LTM" has been indicated. |

[0041] With the above example information in mind, a UE in one embodiment performs a method, wherein the UE is configured with a first set of LTM related configuration(s). The method includes the UE deleting (releasing/ discarding/removing) the first set of one or more LTM related configurations in response to receiving the message from the network to suspend the connection, or during an initiation of a resume procedure. There are different manners to define that LTM related configurations are not used when the UE tries to resume, the difference being the timing in which the deletion of the first set of LTM related configuration occurs, either during suspend or during the resume operation.

[0042] In an example scenario, the UE initiates a resume procedure, transmits an RRC resume request, receives an RRC Resume message which includes a second set of LTM related configuration(s), which may either be the same or different than the first set of one or more LTM related parameters. When the UE applies the second set of the LTM related configuration(s) it starts to operate accordingly.

[0043] Another example method of operation by a UE configured with a first set of LTM related configuration(s) includes the UE storing the first set of one or more LTM related configurations, in response to receiving the message from the network to suspend the connection.

25 [0044] Correspondingly, the UE initiates a resume procedure by transmitting an RRC resume request. The UE receives an RRC Resume message which may or may not include first indication (e.g. resume LTM field). When that first indication is included, the UE restores the first set of one or more LTM related configuration(s); when that first indication is absent, the UE releases the first set of one or more LTM related configuration(s). The RRC resume

message the UE receives may also include a second set of LTM related configuration(s) which may either be the same as the first set of LTM related configuration(s) or different. Thus, in at least one example embodiment or scenario of operation, the UE has a first set of LTM related configurations stored for use when it resumes its active connection, and decides whether to  
 5 restore the first set of LTM related configurations in dependence on whether the RRC Resume message returned to it by the network indicates restoration or deletion. The indication may be explicit, e.g., a flag that is set or cleared, or may be implicit, e.g., the absence of a restoration indication, or the inclusion of LTM related configuration(s), such that the UE knows to replace or modify its stored LTM related configurations.

10 [0045] The first/stored LTM related configurations may correspond to at least one or more of these:

[0046] i) Lower layer (CSI) measurement configuration(s) for LTM;

[0047] ii) Time Alignment acquisition (also called UL pre-sync configuration);

[0048] iii) TCI state configuration(s) for pre-sync (also called DL pre-sync configuration);

15 [0049] iv) LTM Reference configuration(s);

[0050] v) LTM Candidate Cell Configuration (s);

[0051] vi) Complete LTM candidate cell configuration(s) generated when the UE is configured with LTM.

[0052] An example method of operation by a serving CU includes the CU Transmitting to  
 20 the UE a first set of one or more LTM related configuration(s) and deleting (releasing/ discarding/ removing) the first set of one or more LTM related configurations in response to transmitting a message to the UE to transition the UE to Inactive state, or performing such deletion during an initiation of a resume procedure.

[0053] As part of the method, the CU deleting (releasing/ discarding/ removing) the first  
 25 set of one or more LTM related configurations by transmitting ~~release message to at least one candidate DU~~ for releasing the first set of LTM related configuration(s) at the Candidate DU, wherein the first set of LTM related configuration(s) is associated to an LTM candidate cell of the at least one Candidate DU.

[0054] As part of the method, when the UE resume in the same CU, the CU receives from  
 30 the UE an RRC Resume Request message and transmits an RRC Resume message including a second set of one or more LTM related configuration(s), wherein the second set of one or more LTM related configuration(s) may be the same or different than the first set of one or more LTM related parameters.

[0055] A second example method by a first network node operating as a serving CU with respect to a UE, the CE transmits to the UE a first set of one or more LTM related configuration(s); and stores the first set of one or more LTM related configurations in response to transmitting the message to the UE to transition the UE to Inactive state. As part of the method, the CU suspends the first set of one or more LTM related configurations by transmitting a message to at least one Candidate DU for suspending the first set of LTM related configuration(s) at the Candidate DU, wherein the first set of LTM related configuration(s) is associated to an LTM candidate cell of the at least one Candidate DU. Further, the method includes the CU receiving from the UE an RRC Resume Request message and transmitting an RRC Resume message, which may or may not include a first indication (e.g., restore LTM field) which indicates to the UE that the UE shall restore or not the first set of stored LTM related configuration(s).

[0056] As part of the method, the CU may include in the RRC Resume message which it transmits to the UE a second set of one or more related LTM configuration(s) to be applied by the UE as part of the RRC resume procedure, wherein the second set of one or more related LTM configuration(s) may be the same or different than the first set of one or more LTM related parameters.

[0057] As part of the method, the first network node receives a message requesting UE Context from a second network node, based on which the first network node deletes the first set of LTM related configuration(s) from a UE Inactive AS Context before it responds including in the response message the UE Inactive AS Context (without the first set of LTM related configuration(s)).

[0058] **Figure QQ1** shows an example of a communication system QQ100 in accordance with some embodiments.

[0059] In the example, the communication system QQ100 includes a telecommunication network QQ102 that includes an access network QQ104, such as a radio access network (RAN), and a core network QQ106, which includes one or more core network nodes QQ108. The access network QQ104 includes one or more access network nodes, such as network nodes QQ110a and QQ110b (one or more of which may be generally referred to as network nodes QQ110), or any other similar 3<sup>rd</sup> Generation Partnership Project (3GPP) access nodes or non-3GPP access points. Moreover, as will be appreciated by those of skill in the art, a network node is not necessarily limited to an implementation in which a radio portion and a baseband portion are supplied and integrated by a single vendor. Thus, it will be understood that network nodes include disaggregated implementations or portions thereof. For example, in some

embodiments, the telecommunication network QQ102 includes one or more Open-RAN (ORAN) network nodes. An ORAN network node is a node in the telecommunication network QQ102 that supports an ORAN specification (e.g., a specification published by the O-RAN Alliance, or any similar organization) and may operate alone or together with other nodes to  
 5 implement one or more functionalities of any node in the telecommunication network QQ102, including one or more network nodes QQ110 and/or core network nodes QQ108.

**[0060]** Examples of an ORAN network node include an open radio unit (O-RU), an open distributed unit (O-DU), an open central unit (O-CU), including an O-CU control plane (O-CU-CP) or an O-CU user plane (O-CU-UP), a RAN intelligent controller (near-real time or  
 10 non-real time) hosting software or software plug-ins, such as a near-real time control application (e.g., xApp) or a non-real time control application (e.g., rApp), or any combination thereof (the adjective “open” designating support of an ORAN specification). The network node may support a specification by, for example, supporting an interface defined by the ORAN specification, such as an A1, F1, W1, E1, E2, X2, Xn interface, an open fronthaul user  
 15 plane interface, or an open fronthaul management plane interface. Moreover, an ORAN access node may be a logical node in a physical node. Furthermore, an ORAN network node may be implemented in a virtualization environment (described further below) in which one or more network functions are virtualized. For example, the virtualization environment may include an O-Cloud computing platform orchestrated by a Service Management and Orchestration  
 20 Framework via an O-2 interface defined by the O-RAN Alliance or comparable technologies. The network nodes QQ110 facilitate direct or indirect connection of user equipment (UE), such as by connecting UEs QQ112a, QQ112b, QQ112c, and QQ112d (one or more of which may be generally referred to as UEs QQ112) to the core network QQ106 over one or more wireless connections.

**[0061]** Example wireless communications over a wireless connection include transmitting and/or receiving wireless signals using electromagnetic waves, radio waves, infrared waves, and/or other types of signals suitable for conveying information without the use of wires, cables, or other material conductors. Moreover, in different embodiments, the communication system QQ100 may include any number of wired or wireless networks, network nodes, UEs,  
 30 and/or any other components or systems that may facilitate or participate in the communication of data and/or signals whether via wired or wireless connections. The communication system QQ100 may include and/or interface with any type of communication, telecommunication, data, cellular, radio network, and/or other similar type of system.

**[0062]** The UEs QQ112 may be any of a wide variety of communication devices, including wireless devices arranged, configured, and/or operable to communicate wirelessly with the network nodes QQ110 and other communication devices. Similarly, the network nodes QQ110 are arranged, capable, configured, and/or operable to communicate directly or indirectly with the UEs QQ112 and/or with other network nodes or equipment in the telecommunication network QQ102 to enable and/or provide network access, such as wireless network access, and/or to perform other functions, such as administration in the telecommunication network QQ102.

**[0063]** In the depicted example, the core network QQ106 connects the network nodes QQ110 to one or more hosts, such as host QQ116. These connections may be direct or indirect via one or more intermediary networks or devices. In other examples, network nodes may be directly coupled to hosts. The core network QQ106 includes one more core network nodes (e.g., core network node QQ108) that are structured with hardware and software components. Features of these components may be substantially similar to those described with respect to the UEs, network nodes, and/or hosts, such that the descriptions thereof are generally applicable to the corresponding components of the core network node QQ108. Example core network nodes include functions of one or more of a Mobile Switching Center (MSC), Mobility Management Entity (MME), Home Subscriber Server (HSS), Access and Mobility Management Function (AMF), Session Management Function (SMF), Authentication Server Function (AUSF), Subscription Identifier De-concealing function (SIDF), Unified Data Management (UDM), Security Edge Protection Proxy (SEPP), Network Exposure Function (NEF), and/or a User Plane Function (UPF).

**[0064]** The host QQ116 may be under the ownership or control of a service provider other than an operator or provider of the access network QQ104 and/or the telecommunication network QQ102, and may be operated by the service provider or on behalf of the service provider. The host QQ116 may host a variety of applications to provide one or more service. Examples of such applications include live and pre-recorded audio/video content, data collection services such as retrieving and compiling data on various ambient conditions detected by a plurality of UEs, analytics functionality, social media, functions for controlling or otherwise interacting with remote devices, functions for an alarm and surveillance center, or any other such function performed by a server.

**[0065]** As a whole, the communication system QQ100 of Figure QQ1 enables connectivity between the UEs, network nodes, and hosts. In that sense, the communication system may be configured to operate according to predefined rules or procedures, such as specific standards

that include, but are not limited to: Global System for Mobile Communications (GSM); Universal Mobile Telecommunications System (UMTS); Long Term Evolution (LTE), and/or other suitable 2G, 3G, 4G, 5G standards, or any applicable future generation standard (e.g., 6G); wireless local area network (WLAN) standards, such as the Institute of Electrical and Electronics Engineers (IEEE) 802.11 standards (WiFi); and/or any other appropriate wireless communication standard, such as the Worldwide Interoperability for Microwave Access (WiMax), Bluetooth, Z-Wave, Near Field Communication (NFC) ZigBee, LiFi, and/or any low-power wide-area network (LPWAN) standards such as LoRa and Sigfox.

[0066] In some examples, the telecommunication network QQ102 is a cellular network that implements 3GPP standardized features. Accordingly, the telecommunications network QQ102 may support network slicing to provide different logical networks to different devices that are connected to the telecommunication network QQ102. For example, the telecommunications network QQ102 may provide Ultra Reliable Low Latency Communication (URLLC) services to some UEs, while providing Enhanced Mobile Broadband (eMBB) services to other UEs, and/or Massive Machine Type Communication (mMTC)/Massive IoT services to yet further UEs.

[0067] In some examples, the UEs QQ112 are configured to transmit and/or receive information without direct human interaction. For instance, a UE may be designed to transmit information to the access network QQ104 on a predetermined schedule, when triggered by an internal or external event, or in response to requests from the access network QQ104. Additionally, a UE may be configured for operating in single- or multi-RAT or multi-standard mode. For example, a UE may operate with any one or combination of Wi-Fi, NR (New Radio) and LTE, i.e. being configured for multi-radio dual connectivity (MR-DC), such as E-UTRAN (Evolved-UMTS Terrestrial Radio Access Network) New Radio – Dual Connectivity (EN-DC).

[0068] In the example, the hub QQ114 communicates with the access network QQ104 to facilitate indirect communication between one or more UEs (e.g., UE QQ112c and/or QQ112d) and network nodes (e.g., network node QQ110b). In some examples, the hub QQ114 may be a controller, router, content source and analytics, or any of the other communication devices described herein regarding UEs. For example, the hub QQ114 may be a broadband router enabling access to the core network QQ106 for the UEs. As another example, the hub QQ114 may be a controller that sends commands or instructions to one or more actuators in the UEs. Commands or instructions may be received from the UEs, network nodes QQ110, or by executable code, script, process, or other instructions in the hub QQ114. As another example,

the hub QQ114 may be a data collector that acts as temporary storage for UE data and, in some embodiments, may perform analysis or other processing of the data. As another example, the hub QQ114 may be a content source. For example, for a UE that is a VR headset, display, loudspeaker or other media delivery device, the hub QQ114 may retrieve VR assets, video, audio, or other media or data related to sensory information via a network node, which the hub QQ114 then provides to the UE either directly, after performing local processing, and/or after adding additional local content. In still another example, the hub QQ114 acts as a proxy server or orchestrator for the UEs, in particular if one or more of the UEs are low energy IoT devices.

[0069] The hub QQ114 may have a constant/persistent or intermittent connection to the network node QQ110b. The hub QQ114 may also allow for a different communication scheme and/or schedule between the hub QQ114 and UEs (e.g., UE QQ112c and/or QQ112d), and between the hub QQ114 and the core network QQ106. In other examples, the hub QQ114 is connected to the core network QQ106 and/or one or more UEs via a wired connection. Moreover, the hub QQ114 may be configured to connect to an M2M service provider over the access network QQ104 and/or to another UE over a direct connection. In some scenarios, UEs may establish a wireless connection with the network nodes QQ110 while still connected via the hub QQ114 via a wired or wireless connection. In some embodiments, the hub QQ114 may be a dedicated hub – that is, a hub whose primary function is to route communications to/from the UEs from/to the network node QQ110b. In other embodiments, the hub QQ114 may be a non-dedicated hub – that is, a device which is capable of operating to route communications between the UEs and network node QQ110b, but which is additionally capable of operating as a communication start and/or end point for certain data channels.

[0070] The communication system QQ100 may be configured in accordance with the techniques disclosed herein, e.g., one or more of the UEs QQ112 are configured to perform the conditional restore/delete operations described herein for LTM related configurations in the context of connection suspension/resumption. Correspondingly, one or more of the network nodes QQ110 are configured as CU/DU systems, with at least one such CU configured to perform the serving CU operations described herein. The same applies with respect to the subsequent figures, such as Figure QQ2.

[0071] **Figure QQ2** shows a UE QQ200 in accordance with some embodiments. As used herein, a UE refers to a device capable, configured, arranged and/or operable to communicate wirelessly with network nodes and/or other UEs. Examples of a UE include, but are not limited to, a smart phone, mobile phone, cell phone, voice over IP (VoIP) phone, wireless local loop phone, desktop computer, personal digital assistant (PDA), wireless cameras, gaming console

or device, music storage device, playback appliance, wearable terminal device, wireless endpoint, mobile station, tablet, laptop, laptop-embedded equipment (LEE), laptop-mounted equipment (LME), smart device, wireless customer-premise equipment (CPE), vehicle, vehicle-mounted or vehicle embedded/integrated wireless device, etc. Other examples include  
 5 any UE identified by the 3rd Generation Partnership Project (3GPP), including a narrow band internet of things (NB-IoT) UE, a machine type communication (MTC) UE, and/or an enhanced MTC (eMTC) UE.

**[0072]** A UE may support device-to-device (D2D) communication, for example by implementing a 3GPP standard for sidelink communication, Dedicated Short-Range  
 10 Communication (DSRC), vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), or vehicle-to-everything (V2X). In other examples, a UE may not necessarily have a user in the sense of a human user who owns and/or operates the relevant device. Instead, a UE may represent a device that is intended for sale to, or operation by, a human user but which may not, or which may not initially, be associated with a specific human user (e.g., a smart sprinkler controller).  
 15 Alternatively, a UE may represent a device that is not intended for sale to, or operation by, an end user but which may be associated with or operated for the benefit of a user (e.g., a smart power meter).

**[0073]** The UE QQ200 includes processing circuitry QQ202 that is operatively coupled via a bus QQ204 to an input/output interface QQ206, a power source QQ208, a memory  
 20 QQ210, a communication interface QQ212, and/or any other component, or any combination thereof. Certain UEs may utilize all or a subset of the components shown in Figure QQ2. The level of integration between the components may vary from one UE to another UE. Further, certain UEs may contain multiple instances of a component, such as multiple processors, memories, transceivers, transmitters, receivers, etc.

**[0074]** The processing circuitry QQ202 is configured to process instructions and data and may be configured to implement any sequential state machine operative to execute instructions stored as machine-readable computer programs in the memory QQ210. The processing circuitry QQ202 may be implemented as one or more hardware-implemented state machines (e.g., in discrete logic, field-programmable gate arrays (FPGAs), application specific integrated  
 30 circuits (ASICs), etc.); programmable logic together with appropriate firmware; one or more stored computer programs, general-purpose processors, such as a microprocessor or digital signal processor (DSP), together with appropriate software; or any combination of the above. For example, the processing circuitry QQ202 may include multiple central processing units (CPUs).

**[0075]** In the example, the input/output interface QQ206 may be configured to provide an interface or interfaces to an input device, output device, or one or more input and/or output devices. Examples of an output device include a speaker, a sound card, a video card, a display, a monitor, a printer, an actuator, an emitter, a smartcard, another output device, or any combination thereof. An input device may allow a user to capture information into the UE QQ200. Examples of an input device include a touch-sensitive or presence-sensitive display, a camera (e.g., a digital camera, a digital video camera, a web camera, etc.), a microphone, a sensor, a mouse, a trackball, a directional pad, a trackpad, a scroll wheel, a smartcard, and the like. The presence-sensitive display may include a capacitive or resistive touch sensor to sense input from a user. A sensor may be, for instance, an accelerometer, a gyroscope, a tilt sensor, a force sensor, a magnetometer, an optical sensor, a proximity sensor, a biometric sensor, etc., or any combination thereof. An output device may use the same type of interface port as an input device. For example, a Universal Serial Bus (USB) port may be used to provide an input device and an output device.

**[0076]** In some embodiments, the power source QQ208 is structured as a battery or battery pack. Other types of power sources, such as an external power source (e.g., an electricity outlet), photovoltaic device, or power cell, may be used. The power source QQ208 may further include power circuitry for delivering power from the power source QQ208 itself, and/or an external power source, to the various parts of the UE QQ200 via input circuitry or an interface such as an electrical power cable. Delivering power may be, for example, for charging of the power source QQ208. Power circuitry may perform any formatting, converting, or other modification to the power from the power source QQ208 to make the power suitable for the respective components of the UE QQ200 to which power is supplied.

**[0077]** The memory QQ210 may be or be configured to include memory such as random access memory (RAM), read-only memory (ROM), programmable read-only memory (PROM), erasable programmable read-only memory (EPROM), electrically erasable programmable read-only memory (EEPROM), magnetic disks, optical disks, hard disks, removable cartridges, flash drives, and so forth. In one example, the memory QQ210 includes one or more application programs QQ214, such as an operating system, web browser application, a widget, gadget engine, or other application, and corresponding data QQ216. The memory QQ210 may store, for use by the UE QQ200, any of a variety of various operating systems or combinations of operating systems.

**[0078]** The memory QQ210 may be configured to include a number of physical drive units, such as redundant array of independent disks (RAID), flash memory, USB flash drive,

external hard disk drive, thumb drive, pen drive, key drive, high-density digital versatile disc (HD-DVD) optical disc drive, internal hard disk drive, Blu-Ray optical disc drive, holographic digital data storage (HDDS) optical disc drive, external mini-dual in-line memory module (DIMM), synchronous dynamic random access memory (SDRAM), external micro-DIMM SDRAM, smartcard memory such as tamper resistant module in the form of a universal integrated circuit card (UICC) including one or more subscriber identity modules (SIMs), such as a USIM and/or ISIM, other memory, or any combination thereof. The UICC may for example be an embedded UICC (eUICC), integrated UICC (iUICC) or a removable UICC commonly known as 'SIM card.' The memory QQ210 may allow the UE QQ200 to access instructions, application programs and the like, stored on transitory or non-transitory memory media, to off-load data, or to upload data. An article of manufacture, such as one utilizing a communication system may be tangibly embodied as or in the memory QQ210, which may be or comprise a device-readable storage medium.

**[0079]** The processing circuitry QQ202 may be configured to communicate with an access network or other network using the communication interface QQ212. The communication interface QQ212 may comprise one or more communication subsystems and may include or be communicatively coupled to an antenna QQ222. The communication interface QQ212 may include one or more transceivers used to communicate, such as by communicating with one or more remote transceivers of another device capable of wireless communication (e.g., another UE or a network node in an access network). Each transceiver may include a transmitter QQ218 and/or a receiver QQ220 appropriate to provide network communications (e.g., optical, electrical, frequency allocations, and so forth). Moreover, the transmitter QQ218 and receiver QQ220 may be coupled to one or more antennas (e.g., antenna QQ222) and may share circuit components, software or firmware, or alternatively be implemented separately.

**[0080]** In the illustrated embodiment, communication functions of the communication interface QQ212 may include cellular communication, Wi-Fi communication, LPWAN communication, data communication, voice communication, multimedia communication, short-range communications such as Bluetooth, near-field communication, location-based communication such as the use of the global positioning system (GPS) to determine a location, another like communication function, or any combination thereof. Communications may be implemented in according to one or more communication protocols and/or standards, such as IEEE 802.11, Code Division Multiplexing Access (CDMA), Wideband Code Division Multiple Access (WCDMA), GSM, LTE, New Radio (NR), UMTS, WiMax, Ethernet, transmission control protocol/internet protocol (TCP/IP), synchronous optical networking

(SONET), Asynchronous Transfer Mode (ATM), QUIC, Hypertext Transfer Protocol (HTTP), and so forth.

**[0081]** Regardless of the type of sensor, a UE may provide an output of data captured by its sensors, through its communication interface QQ212, via a wireless connection to a network node. Data captured by sensors of a UE can be communicated through a wireless connection to a network node via another UE. The output may be periodic (e.g., once every 15 minutes if it reports the sensed temperature), random (e.g., to even out the load from reporting from several sensors), in response to a triggering event (e.g., when moisture is detected, an alert is sent), in response to a request (e.g., a user initiated request), or a continuous stream (e.g., a live video feed of a patient).

**[0082]** As another example, a UE comprises an actuator, a motor, or a switch, related to a communication interface configured to receive wireless input from a network node via a wireless connection. In response to the received wireless input the states of the actuator, the motor, or the switch may change. For example, the UE may comprise a motor that adjusts the control surfaces or rotors of a drone in flight according to the received input or to a robotic arm performing a medical procedure according to the received input.

**[0083]** A UE, when in the form of an Internet of Things (IoT) device, may be a device for use in one or more application domains, these domains comprising, but not limited to, city wearable technology, extended industrial application and healthcare. Non-limiting examples of such an IoT device are a device which is or which is embedded in: a connected refrigerator or freezer, a TV, a connected lighting device, an electricity meter, a robot vacuum cleaner, a voice controlled smart speaker, a home security camera, a motion detector, a thermostat, a smoke detector, a door/window sensor, a flood/moisture sensor, an electrical door lock, a connected doorbell, an air conditioning system like a heat pump, an autonomous vehicle, a surveillance system, a weather monitoring device, a vehicle parking monitoring device, an electric vehicle charging station, a smart watch, a fitness tracker, a head-mounted display for Augmented Reality (AR) or Virtual Reality (VR), a wearable for tactile augmentation or sensory enhancement, a water sprinkler, an animal- or item-tracking device, a sensor for monitoring a plant or animal, an industrial robot, an Unmanned Aerial Vehicle (UAV), and any kind of medical device, like a heart rate monitor or a remote controlled surgical robot. A UE in the form of an IoT device comprises circuitry and/or software in dependence of the intended application of the IoT device in addition to other components as described in relation to the UE QQ200 shown in Figure QQ2.

[0084] As yet another specific example, in an IoT scenario, a UE may represent a machine or other device that performs monitoring and/or measurements, and transmits the results of such monitoring and/or measurements to another UE and/or a network node. The UE may in this case be an M2M device, which may in a 3GPP context be referred to as an MTC device.

5 As one particular example, the UE may implement the 3GPP NB-IoT standard. In other scenarios, a UE may represent a vehicle, such as a car, a bus, a truck, a ship and an airplane, or other equipment that is capable of monitoring and/or reporting on its operational status or other functions associated with its operation.

[0085] In practice, any number of UEs may be used together with respect to a single use case. For example, a first UE might be or be integrated in a drone and provide the drone's speed information (obtained through a speed sensor) to a second UE that is a remote controller operating the drone. When the user makes changes from the remote controller, the first UE may adjust the throttle on the drone (e.g. by controlling an actuator) to increase or decrease the drone's speed. The first and/or the second UE can also include more than one of the functionalities described above. For example, a UE might comprise the sensor and the actuator, and handle communication of data for both the speed sensor and the actuators.

[0086] **Figure QQ3** shows a network node QQ300 in accordance with some embodiments. As used herein, network node refers to equipment capable, configured, arranged and/or operable to communicate directly or indirectly with a UE and/or with other network nodes or equipment, in a telecommunication network. Examples of network nodes include, but are not limited to, access points (APs) (e.g., radio access points), base stations (BSs) (e.g., radio base stations, Node Bs, evolved Node Bs (eNBs) and NR NodeBs (gNBs)), O-RAN nodes or components of an O-RAN node (e.g., O-RU, O-DU, O-CU).

[0087] Base stations may be categorized based on the amount of coverage they provide (or, stated differently, their transmit power level) and so, depending on the provided amount of coverage, may be referred to as femto base stations, pico base stations, micro base stations, or macro base stations. A base station may be a relay node or a relay donor node controlling a relay. A network node may also include one or more (or all) parts of a distributed radio base station such as centralized digital units, distributed units (e.g., in an O-RAN access node) and/or remote radio units (RRUs), sometimes referred to as Remote Radio Heads (RRHs). Such remote radio units may or may not be integrated with an antenna as an antenna integrated radio. Parts of a distributed radio base station may also be referred to as nodes in a distributed antenna system (DAS).

**[0088]** Other examples of network nodes include multiple transmission point (multi-TRP) 5G access nodes, multi-standard radio (MSR) equipment such as MSR BSs, network controllers such as radio network controllers (RNCs) or base station controllers (BSCs), base transceiver stations (BTSs), transmission points, transmission nodes, multi-cell/multicast  
 5 coordination entities (MCEs), Operation and Maintenance (O&M) nodes, Operations Support System (OSS) nodes, Self-Organizing Network (SON) nodes, positioning nodes (e.g., Evolved Serving Mobile Location Centers (E-SMLCs)), and/or Minimization of Drive Tests (MDTs).

**[0089]** The network node QQ300 includes a processing circuitry QQ302, a memory QQ304, a communication interface QQ306, and a power source QQ308. The network node  
 10 QQ300 may be composed of multiple physically separate components (e.g., a NodeB component and a RNC component, or a BTS component and a BSC component, etc.), which may each have their own respective components. In certain scenarios in which the network node QQ300 comprises multiple separate components (e.g., BTS and BSC components), one or more of the separate components may be shared among several network nodes. For example,  
 15 a single RNC may control multiple NodeBs. In such a scenario, each unique NodeB and RNC pair, may in some instances be considered a single separate network node. In some embodiments, the network node QQ300 may be configured to support multiple radio access technologies (RATs). In such embodiments, some components may be duplicated (e.g., separate memory QQ304 for different RATs) and some components may be reused (e.g., a  
 20 same antenna QQ310 may be shared by different RATs). The network node QQ300 may also include multiple sets of the various illustrated components for different wireless technologies integrated into network node QQ300, for example GSM, WCDMA, LTE, NR, WiFi, Zigbee, Z-wave, LoRaWAN, Radio Frequency Identification (RFID) or Bluetooth wireless technologies. These wireless technologies may be integrated into the same or different chip or  
 25 set of chips and other components within network node QQ300.

**[0090]** The processing circuitry QQ302 may comprise a combination of one or more of a microprocessor, controller, microcontroller, central processing unit, digital signal processor, application-specific integrated circuit, field programmable gate array, or any other suitable  
 30 computing device, resource, or combination of hardware, software and/or encoded logic operable to provide, either alone or in conjunction with other network node QQ300 components, such as the memory QQ304, to provide network node QQ300 functionality.

**[0091]** In some embodiments, the processing circuitry QQ302 includes a system on a chip (SOC). In some embodiments, the processing circuitry QQ302 includes one or more of radio frequency (RF) transceiver circuitry QQ312 and baseband processing circuitry QQ314. In

some embodiments, the radio frequency (RF) transceiver circuitry QQ312 and the baseband processing circuitry QQ314 may be on separate chips (or sets of chips), boards, or units, such as radio units and digital units. In alternative embodiments, part or all of RF transceiver circuitry QQ312 and baseband processing circuitry QQ314 may be on the same chip or set of chips, boards, or units.

[0092] The memory QQ304 may comprise any form of volatile or non-volatile computer-readable memory including, without limitation, persistent storage, solid-state memory, remotely mounted memory, magnetic media, optical media, random access memory (RAM), read-only memory (ROM), mass storage media (for example, a hard disk), removable storage media (for example, a flash drive, a Compact Disk (CD) or a Digital Video Disk (DVD)), and/or any other volatile or non-volatile, non-transitory device-readable and/or computer-executable memory devices that store information, data, and/or instructions that may be used by the processing circuitry QQ302. The memory QQ304 may store any suitable instructions, data, or information, including a computer program, software, an application including one or more of logic, rules, code, tables, and/or other instructions capable of being executed by the processing circuitry QQ302 and utilized by the network node QQ300. The memory QQ304 may be used to store any calculations made by the processing circuitry QQ302 and/or any data received via the communication interface QQ306. In some embodiments, the processing circuitry QQ302 and memory QQ304 is integrated.

[0093] The communication interface QQ306 is used in wired or wireless communication of signaling and/or data between a network node, access network, and/or UE. As illustrated, the communication interface QQ306 comprises port(s)/terminal(s) QQ316 to send and receive data, for example to and from a network over a wired connection. The communication interface QQ306 also includes radio front-end circuitry QQ318 that may be coupled to, or in certain embodiments a part of, the antenna QQ310. Radio front-end circuitry QQ318 comprises filters QQ320 and amplifiers QQ322. The radio front-end circuitry QQ318 may be connected to an antenna QQ310 and processing circuitry QQ302. The radio front-end circuitry may be configured to condition signals communicated between antenna QQ310 and processing circuitry QQ302. The radio front-end circuitry QQ318 may receive digital data that is to be sent out to other network nodes or UEs via a wireless connection. The radio front-end circuitry QQ318 may convert the digital data into a radio signal having the appropriate channel and bandwidth parameters using a combination of filters QQ320 and/or amplifiers QQ322. The radio signal may then be transmitted via the antenna QQ310. Similarly, when receiving data, the antenna QQ310 may collect radio signals which are then converted into digital data by the

radio front-end circuitry QQ318. The digital data may be passed to the processing circuitry QQ302. In other embodiments, the communication interface may comprise different components and/or different combinations of components.

[0094] In certain alternative embodiments, the network node QQ300 does not include  
5 separate radio front-end circuitry QQ318, instead, the processing circuitry QQ302 includes radio front-end circuitry and is connected to the antenna QQ310. Similarly, in some embodiments, all or some of the RF transceiver circuitry QQ312 is part of the communication interface QQ306. In still other embodiments, the communication interface QQ306 includes one or more ports or terminals QQ316, the radio front-end circuitry QQ318, and the RF transceiver  
10 circuitry QQ312, as part of a radio unit (not shown), and the communication interface QQ306 communicates with the baseband processing circuitry QQ314, which is part of a digital unit (not shown).

[0095] The antenna QQ310 may include one or more antennas, or antenna arrays, configured to send and/or receive wireless signals. The antenna QQ310 may be coupled to the  
15 radio front-end circuitry QQ318 and may be any type of antenna capable of transmitting and receiving data and/or signals wirelessly. In certain embodiments, the antenna QQ310 is separate from the network node QQ300 and connectable to the network node QQ300 through an interface or port.

[0096] The antenna QQ310, communication interface QQ306, and/or the processing  
20 circuitry QQ302 may be configured to perform any receiving operations and/or certain obtaining operations described herein as being performed by the network node. Any information, data and/or signals may be received from a UE, another network node and/or any other network equipment. Similarly, the antenna QQ310, the communication interface QQ306, and/or the processing circuitry QQ302 may be configured to perform any transmitting  
25 operations described herein as being performed by the network node. Any information, data and/or signals may be transmitted to a UE, another network node and/or any other network equipment.

[0097] The power source QQ308 provides power to the various components of network node QQ300 in a form suitable for the respective components (e.g., at a voltage and current  
30 level needed for each respective component). The power source QQ308 may further comprise, or be coupled to, power management circuitry to supply the components of the network node QQ300 with power for performing the functionality described herein. For example, the network node QQ300 may be connectable to an external power source (e.g., the power grid, an electricity outlet) via an input circuitry or interface such as an electrical cable, whereby the

external power source supplies power to power circuitry of the power source QQ308. As a further example, the power source QQ308 may comprise a source of power in the form of a battery or battery pack which is connected to, or integrated in, power circuitry. The battery may provide backup power should the external power source fail.

5 [0098] Embodiments of the network node QQ300 may include additional components beyond those shown in Figure QQ3 for providing certain aspects of the network node's functionality, including any of the functionality described herein and/or any functionality necessary to support the subject matter described herein. For example, the network node QQ300 may include user interface equipment to allow input of information into the network  
10 node QQ300 and to allow output of information from the network node QQ300. This may allow a user to perform diagnostic, maintenance, repair, and other administrative functions for the network node QQ300.

[0099] **Figure QQ4** is a block diagram of a host QQ400, which may be an embodiment of the host QQ116 of Figure QQ1, in accordance with various aspects described herein. As  
15 used herein, the host QQ400 may be or comprise various combinations hardware and/or software, including a standalone server, a blade server, a cloud-implemented server, a distributed server, a virtual machine, container, or processing resources in a server farm. The host QQ400 may provide one or more services to one or more UEs.

[0100] The host QQ400 includes processing circuitry QQ402 that is operatively coupled  
20 via a bus QQ404 to an input/output interface QQ406, a network interface QQ408, a power source QQ410, and a memory QQ412. Other components may be included in other embodiments. Features of these components may be substantially similar to those described with respect to the devices of previous figures, such as Figures QQ2 and QQ3, such that the descriptions thereof are generally applicable to the corresponding components of host QQ400.

25 [0101] The memory QQ412 may include one or more computer programs including one or more host application programs QQ414 and data QQ416, which may include user data, e.g., data generated by a UE for the host QQ400 or data generated by the host QQ400 for a UE. Embodiments of the host QQ400 may utilize only a subset or all of the components shown. The host application programs QQ414 may be implemented in a container-based architecture  
30 and may provide support for video codecs (e.g., Versatile Video Coding (VVC), High Efficiency Video Coding (HEVC), Advanced Video Coding (AVC), MPEG, VP9) and audio codecs (e.g., FLAC, Advanced Audio Coding (AAC), MPEG, G.711), including transcoding for multiple different classes, types, or implementations of UEs (e.g., handsets, desktop computers, wearable display systems, heads-up display systems). The host application

programs QQ414 may also provide for user authentication and licensing checks and may periodically report health, routes, and content availability to a central node, such as a device in or on the edge of a core network. Accordingly, the host QQ400 may select and/or indicate a different host for over-the-top services for a UE. The host application programs QQ414 may support various protocols, such as the HTTP Live Streaming (HLS) protocol, Real-Time Messaging Protocol (RTMP), Real-Time Streaming Protocol (RTSP), Dynamic Adaptive Streaming over HTTP (MPEG-DASH), etc.

**[0102]** **Figure QQ5** is a block diagram illustrating a virtualization environment QQ500 in which functions implemented by some embodiments may be virtualized. In the present context, virtualizing means creating virtual versions of apparatuses or devices which may include virtualizing hardware platforms, storage devices and networking resources. As used herein, virtualization can be applied to any device described herein, or components thereof, and relates to an implementation in which at least a portion of the functionality is implemented as one or more virtual components. Some or all of the functions described herein may be implemented as virtual components executed by one or more virtual machines (VMs) implemented in one or more virtual environments QQ500 hosted by one or more of hardware nodes, such as a hardware computing device that operates as a network node, UE, core network node, or host. Further, in embodiments in which the virtual node does not require radio connectivity (e.g., a core network node or host), then the node may be entirely virtualized. In some embodiments, the virtualization environment QQ500 includes components defined by the O-RAN Alliance, such as an O-Cloud environment orchestrated by a Service Management and Orchestration Framework via an O-2 interface.

**[0103]** Applications QQ502 (which may alternatively be called software instances, virtual appliances, network functions, virtual nodes, virtual network functions, etc.) are run in the virtualization environment Q400 to implement some of the features, functions, and/or benefits of some of the embodiments disclosed herein.

**[0104]** Hardware QQ504 includes processing circuitry, memory that stores software and/or instructions executable by hardware processing circuitry, and/or other hardware devices as described herein, such as a network interface, input/output interface, and so forth. Software may be executed by the processing circuitry to instantiate one or more virtualization layers QQ506 (also referred to as hypervisors or virtual machine monitors (VMMs)), provide VMs QQ508a and QQ508b (one or more of which may be generally referred to as VMs QQ508), and/or perform any of the functions, features and/or benefits described in relation with some

embodiments described herein. The virtualization layer QQ506 may present a virtual operating platform that appears like networking hardware to the VMs QQ508.

[0105] The VMs QQ508 comprise virtual processing, virtual memory, virtual networking or interface and virtual storage, and may be run by a corresponding virtualization layer QQ506.

5 Different embodiments of the instance of a virtual appliance QQ502 may be implemented on one or more of VMs QQ508, and the implementations may be made in different ways. Virtualization of the hardware is in some contexts referred to as network function virtualization (NFV). NFV may be used to consolidate many network equipment types onto industry standard high volume server hardware, physical switches, and physical storage, which can be located in  
10 data centers, and customer premise equipment.

[0106] In the context of NFV, a VM QQ508 may be a software implementation of a physical machine that runs programs as if they were executing on a physical, non-virtualized machine. Each of the VMs QQ508, and that part of hardware QQ504 that executes that VM, be it hardware dedicated to that VM and/or hardware shared by that VM with others of the  
15 VMs, forms separate virtual network elements. Still in the context of NFV, a virtual network function is responsible for handling specific network functions that run in one or more VMs QQ508 on top of the hardware QQ504 and corresponds to the application QQ502.

[0107] Hardware QQ504 may be implemented in a standalone network node with generic or specific components. Hardware QQ504 may implement some functions via virtualization.  
20 Alternatively, hardware QQ504 may be part of a larger cluster of hardware (e.g. such as in a data center or CPE) where many hardware nodes work together and are managed via management and orchestration QQ510, which, among others, oversees lifecycle management of applications QQ502. In some embodiments, hardware QQ504 is coupled to one or more radio units that each include one or more transmitters and one or more receivers that may be  
25 coupled to one or more antennas. Radio units may communicate directly with other hardware nodes via one or more appropriate network interfaces and may be used in combination with the virtual components to provide a virtual node with radio capabilities, such as a radio access node or a base station. In some embodiments, some signaling can be provided with the use of a control system QQ512 which may alternatively be used for communication between hardware  
30 nodes and radio units.

[0108] **Figure QQ6** shows a communication diagram of a host QQ602 communicating via a network node QQ604 with a UE QQ606 over a partially wireless connection in accordance with some embodiments. Example implementations, in accordance with various embodiments, of the UE (such as a UE QQ112a of Figure QQ1 and/or UE QQ200 of Figure

QQ2), network node (such as network node QQ110a of Figure QQ1 and/or network node QQ300 of Figure QQ3), and host (such as host QQ116 of Figure QQ1 and/or host QQ400 of Figure QQ4) discussed in the preceding paragraphs will now be described with reference to Figure QQ6.

5   **[0109]**     Like host QQ400, embodiments of host QQ602 include hardware, such as a communication interface, processing circuitry, and memory. The host QQ602 also includes software, which is stored in or accessible by the host QQ602 and executable by the processing circuitry. The software includes a host application that may be operable to provide a service to a remote user, such as the UE QQ606 connecting via an over-the-top (OTT) connection QQ650  
10   extending between the UE QQ606 and host QQ602. In providing the service to the remote user, a host application may provide user data which is transmitted using the OTT connection QQ650.

**[0110]**     The network node QQ604 includes hardware enabling it to communicate with the host QQ602 and UE QQ606. The connection QQ660 may be direct or pass through a core network (like core network QQ106 of Figure QQ1) and/or one or more other intermediate networks, such as one or more public, private, or hosted networks. For example, an  
15   intermediate network may be a backbone network or the Internet.

**[0111]**     The UE QQ606 includes hardware and software, which is stored in or accessible by UE QQ606 and executable by the UE's processing circuitry. The software includes a client  
20   application, such as a web browser or operator-specific "app" that may be operable to provide a service to a human or non-human user via UE QQ606 with the support of the host QQ602. In the host QQ602, an executing host application may communicate with the executing client application via the OTT connection QQ650 terminating at the UE QQ606 and host QQ602. In providing the service to the user, the UE's client application may receive request data from the  
25   host's host application and provide user data in response to the request data. The OTT connection QQ650 may transfer both the request data and the user data. The UE's client application may interact with the user to generate the user data that it provides to the host application through the OTT connection QQ650.

**[0112]**     The OTT connection QQ650 may extend via a connection QQ660 between the host  
30   QQ602 and the network node QQ604 and via a wireless connection QQ670 between the network node QQ604 and the UE QQ606 to provide the connection between the host QQ602 and the UE QQ606. The connection QQ660 and wireless connection QQ670, over which the OTT connection QQ650 may be provided, have been drawn abstractly to illustrate the communication between the host QQ602 and the UE QQ606 via the network node QQ604,

without explicit reference to any intermediary devices and the precise routing of messages via these devices.

**[0113]** As an example of transmitting data via the OTT connection QQ650, in step QQ608, the host QQ602 provides user data, which may be performed by executing a host application.

5 In some embodiments, the user data is associated with a particular human user interacting with the UE QQ606. In other embodiments, the user data is associated with a UE QQ606 that shares data with the host QQ602 without explicit human interaction. In step QQ610, the host QQ602 initiates a transmission carrying the user data towards the UE QQ606. The host QQ602 may initiate the transmission responsive to a request transmitted by the UE QQ606. The request  
10 may be caused by human interaction with the UE QQ606 or by operation of the client application executing on the UE QQ606. The transmission may pass via the network node QQ604, in accordance with the teachings of the embodiments described throughout this disclosure. Accordingly, in step QQ612, the network node QQ604 transmits to the UE QQ606 the user data that was carried in the transmission that the host QQ602 initiated, in accordance  
15 with the teachings of the embodiments described throughout this disclosure. In step QQ614, the UE QQ606 receives the user data carried in the transmission, which may be performed by a client application executed on the UE QQ606 associated with the host application executed by the host QQ602.

**[0114]** In some examples, the UE QQ606 executes a client application which provides  
20 user data to the host QQ602. The user data may be provided in reaction or response to the data received from the host QQ602. Accordingly, in step QQ616, the UE QQ606 may provide user data, which may be performed by executing the client application. In providing the user data, the client application may further consider user input received from the user via an input/output interface of the UE QQ606. Regardless of the specific manner in which the user data was  
25 provided, the UE QQ606 initiates, in step QQ618, transmission of the user data towards the host QQ602 via the network node QQ604. In step QQ620, in accordance with the teachings of the embodiments described throughout this disclosure, the network node QQ604 receives user data from the UE QQ606 and initiates transmission of the received user data towards the host QQ602. In step QQ622, the host QQ602 receives the user data carried in the transmission  
30 initiated by the UE QQ606.

**[0115]** One or more of the various embodiments improve the performance of OTT services provided to the UE QQ606 using the OTT connection QQ650, in which the wireless connection QQ670 forms the last segment. More precisely, the teachings of these embodiments may

improve the connectivity resumption and thereby provide benefits such as more reliable resumption of active connections, which facilitates the delivery of OTT services.

[0116] In an example scenario, factory status information may be collected and analyzed by the host QQ602. As another example, the host QQ602 may process audio and video data which may have been retrieved from a UE for use in creating maps. As another example, the host QQ602 may collect and analyze real-time data to assist in controlling vehicle congestion (e.g., controlling traffic lights). As another example, the host QQ602 may store surveillance video uploaded by a UE. As another example, the host QQ602 may store or control access to media content such as video, audio, VR or AR which it can broadcast, multicast or unicast to UEs. As other examples, the host QQ602 may be used for energy pricing, remote control of non-time critical electrical load to balance power generation needs, location services, presentation services (such as compiling diagrams etc. from data collected from remote devices), or any other function of collecting, retrieving, storing, analyzing and/or transmitting data.

[0117] In some examples, a measurement procedure may be provided for the purpose of monitoring data rate, latency and other factors on which the one or more embodiments improve. There may further be an optional network functionality for reconfiguring the OTT connection QQ650 between the host QQ602 and UE QQ606, in response to variations in the measurement results. The measurement procedure and/or the network functionality for reconfiguring the OTT connection may be implemented in software and hardware of the host QQ602 and/or UE QQ606. In some embodiments, sensors (not shown) may be deployed in or in association with other devices through which the OTT connection QQ650 passes; the sensors may participate in the measurement procedure by supplying values of the monitored quantities exemplified above, or supplying values of other physical quantities from which software may compute or estimate the monitored quantities. The reconfiguring of the OTT connection QQ650 may include message format, retransmission settings, preferred routing etc.; the reconfiguring need not directly alter the operation of the network node QQ604. Such procedures and functionalities may be known and practiced in the art. In certain embodiments, measurements may involve proprietary UE signaling that facilitates measurements of throughput, propagation times, latency and the like, by the host QQ602. The measurements may be implemented in that software causes messages to be transmitted, in particular empty or 'dummy' messages, using the OTT connection QQ650 while monitoring propagation times, errors, etc.

[0118] Although the computing devices described herein (e.g., UEs, network nodes, hosts) may include the illustrated combination of hardware components, other embodiments may

comprise computing devices with different combinations of components. It is to be understood that these computing devices may comprise any suitable combination of hardware and/or software needed to perform the tasks, features, functions and methods disclosed herein. Determining, calculating, obtaining or similar operations described herein may be performed  
5 by processing circuitry, which may process information by, for example, converting the obtained information into other information, comparing the obtained information or converted information to information stored in the network node, and/or performing one or more operations based on the obtained information or converted information, and as a result of said processing making a determination. Moreover, while components are depicted as single boxes  
10 located within a larger box, or nested within multiple boxes, in practice, computing devices may comprise multiple different physical components that make up a single illustrated component, and functionality may be partitioned between separate components. For example, a communication interface may be configured to include any of the components described herein, and/or the functionality of the components may be partitioned between the processing  
15 circuitry and the communication interface. In another example, non-computationally intensive functions of any of such components may be implemented in software or firmware and computationally intensive functions may be implemented in hardware.

[0119] In certain embodiments, some or all of the functionality described herein may be provided by processing circuitry executing instructions stored on in memory, which in certain  
20 embodiments may be a computer program product in the form of a non-transitory computer-readable storage medium. In alternative embodiments, some or all of the functionality may be provided by the processing circuitry without executing instructions stored on a separate or discrete device-readable storage medium, such as in a hard-wired manner. In any of those particular embodiments, whether executing instructions stored on a non-transitory computer-  
25 readable storage medium or not, the processing circuitry can be configured to perform the described functionality. The benefits provided by such functionality are not limited to the processing circuitry alone or to other components of the computing device, but are enjoyed by the computing device as a whole, and/or by end users and a wireless network generally.

## EMBODIMENTS

### Group A Embodiments

1. A method performed by a user equipment (UE) configured for operation with respect to a telecommunications network, the method comprising:  
5 receiving information from the telecommunications network while the UE is  
connected to the telecommunications network, the information indicating a  
lower-layer triggered mobility (LTM) configuration, for use in LTM-based  
mobility of the UE;  
suspending the connection; and  
10 with respect to a subsequent resumption of the connection, determining whether to  
restore the LTM configuration.  
  
2. The method of Embodiment 1, wherein determining whether to restore the LTM  
configuration comprises not restoring the LTM configuration responsive to receiving a  
15 resume message from the telecommunications network that indicates that the LTM  
configuration should not be restored.  
  
3. The method of Embodiment 2, wherein the indication that the LTM configuration  
should not be restored comprises an explicit indication.  
20  
  
4. The method of Embodiment 2, wherein the indication that the LTM configuration  
should not be restored comprises an implicit indication, the implicit indication being the  
absence of an explicit indication that the LTM configuration should be restored.  
  
25 5. The method of Embodiment 2, wherein the indication that the LTM configuration  
should be restored comprises an implicit indication, the implicit indication being the

inclusion of an LTM configuration in the resume message.

6. The method of any one of Embodiments 1-5, wherein determining whether to restore the LTM configuration comprises determining not to restore the LTM configuration based on a resume message received from the telecommunications network including one or more LTM configuration settings, and wherein the method includes replacing or modifying the LTM configuration, rather than restoring the LTM configuration, according to the one or more LTM configuration settings included in the resume message.

7. The method of Embodiment 1, wherein determining whether to restore the LTM configuration comprises restoring the LTM configuration responsive to receiving a resume message from the telecommunications network that indicates that the LTM configuration should be restored.

8. The method of Embodiment 7, wherein the indication that the LTM configuration should be restored comprises an explicit indication.

9. The method of Embodiment 7, wherein the indication that the LTM configuration should be restored comprises an implicit indication, the implicit indication being the absence of an explicit indication that the LTM configuration should not be restored.

10. The method of any one of Embodiments 1-9, wherein the telecommunications network comprises a Third Generation Partnership Project (3GPP) wireless communications network.

11. The method of Embodiment 10, wherein the 3GPP wireless communications network comprises a Fifth Generation (5G) cellular network.

12. The method of any one of Embodiments 1-11, wherein the LTM configuration  
5 comprises a first set of LTM related configuration(s).

13. The method of Embodiment 12, wherein the method includes the UE receiving a resume message and, responsive to the resume message including a second set of LTM related configuration(s), determining to replace or modify the first set of LTM related  
10 configuration(s) with the second set of LTM related configuration(s), rather than restoring the first set of LTM related configurations.

14. The method of any of the previous embodiments, further comprising:  
providing user data; and  
15 forwarding the user data to a host via the transmission to the network node.

#### Group B Embodiments

15. A method performed by a network node in a telecommunications network, the method comprising:  
20 transmitting a lower-layer triggered mobility (LTM) configuration to a user equipment (UE) that is connected to the telecommunications network; and  
controlling whether the UE restores or deletes the LTM configuration in conjunction  
with resumption of the connection.

16. The method of Embodiment 15, wherein controlling whether the UE restores or deletes  
25 the LTM configuration comprises sending an implicit or explicit indication in a resume message transmitted to the UE.

17. The method of Embodiment 16, wherein the indication is an explicit indication to restore

the LTM configuration.

18. The method of Embodiment 17, wherein the explicit indication is a flag.

5 19. The method of Embodiment 16, wherein the indication is an implicit indication to delete the LTM configuration, the implicit indication being one of: an absence of an indication to restore, or the inclusion of an LTM configuration in the resume message.

20. The method of Embodiment 15, wherein the method includes the network node  
10 suspending the connection and wherein controlling whether the UE restores or deletes the LTM configuration in conjunction with resumption of the connection comprises, while the connection is suspended, receiving a request from another network node of the telecommunications network for context information for the UE, and responsive to that request, determining that the UE should not restore the LTM configuration.

15

21. The method of any of the previous embodiments, further comprising:  
obtaining user data; and  
forwarding the user data to a host or a user equipment.

20 Group C Embodiments

22. A user equipment comprising:  
processing circuitry configured to perform any of the steps of any of the Group A  
embodiments; and  
power supply circuitry configured to supply power to the processing circuitry.

25

23. A network node comprising:  
processing circuitry configured to perform any of the steps of any of the Group B  
embodiments;  
power supply circuitry configured to supply power to the processing circuitry.

30

24. A user equipment (UE) comprising:  
an antenna configured to send and receive wireless signals;  
radio front-end circuitry connected to the antenna and to processing circuitry, and  
configured to condition signals communicated between the antenna and the processing

circuitry:

the processing circuitry being configured to perform any of the steps of any of the Group A embodiments;

an input interface connected to the processing circuitry and configured to allow input  
5 of information into the UE to be processed by the processing circuitry;

an output interface connected to the processing circuitry and configured to output information from the UE that has been processed by the processing circuitry; and

a battery connected to the processing circuitry and configured to supply power to the UE.

10

25. A host configured to operate in a communication system to provide an over-the-top (OTT) service, the host comprising:

processing circuitry configured to provide user data; and

a network interface configured to initiate transmission of the user data to a network  
15 node in a cellular network for transmission to a user equipment (UE), the network node having a communication interface and processing circuitry, the processing circuitry of the network node configured to perform any of the operations of any of the Group B embodiments to transmit the user data from the host to the UE.

20 26. The host of the previous embodiment, wherein:

the processing circuitry of the host is configured to execute a host application that provides the user data; and

the UE comprises processing circuitry configured to execute a client application associated with the host application to receive the transmission of user data from the host.

25

27. A method implemented in a host configured to operate in a communication system that further includes a network node and a user equipment (UE), the method comprising:

providing user data for the UE; and

initiating a transmission carrying the user data to the UE via a cellular network  
30 comprising the network node, wherein the network node performs any of the operations of any of the Group B embodiments to transmit the user data from the host to the UE.

28. The method of the previous embodiment, further comprising, at the network node, transmitting the user data provided by the host for the UE.

29. The method of any of the previous 2 embodiments, wherein the user data is provided at the host by executing a host application that interacts with a client application executing on the UE, the client application being associated with the host application.

5

30. A communication system configured to provide an over-the-top (OTT) service, the communication system comprising:

a host comprising:

processing circuitry configured to provide user data for a user equipment (UE), the user data being associated with the over-the-top service; and

10

a network interface configured to initiate transmission of the user data toward a cellular network node for transmission to the UE, the network node having a communication interface and processing circuitry, the processing circuitry of the network node configured to perform any of the operations of any of the Group B embodiments to transmit the user data from the host to the UE.

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31. The communication system of the previous embodiment, further comprising:

the network node; and/or

the UE.

20

32. A host configured to operate in a communication system to provide an over-the-top (OTT) service, the host comprising:

processing circuitry configured to initiate receipt of user data; and

a network interface configured to receive the user data from a network node in a cellular network, the network node having a communication interface and processing circuitry, the processing circuitry of the network node configured to perform any of the operations of any of the Group B embodiments to receive the user data from a user equipment (UE) for the host.

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33. The host of the previous 2 embodiments, wherein:

the processing circuitry of the host is configured to execute a host application that receives the user data; and

30

the host application is configured to interact with a client application executing on the UE, the client application being associated with the host application.

34. The host of the any of the previous 2 embodiments, wherein the initiating receipt of the user data comprises requesting the user data.

35. A method implemented by a host configured to operate in a communication system that further includes a network node and a user equipment (UE), the method comprising:

at the host, initiating receipt of user data from the UE, the user data originating from a transmission which the network node has received from the UE, wherein the network node performs any of the steps of any of the Group B embodiments to receive the user data from the UE for the host.

36. The method of the previous embodiment, further comprising at the network node, transmitting the received user data to the host.

37. A host configured to operate in a communication system to provide an over-the-top (OTT) service, the host comprising:

processing circuitry configured to provide user data; and

a network interface configured to initiate transmission of the user data to a cellular network for transmission to a user equipment (UE), wherein the UE comprises a communication interface and processing circuitry, the communication interface and processing circuitry of the UE being configured to perform any of the operations of any of the Group A embodiments to receive the user data from the host.

38. The host of the previous embodiment, wherein the cellular network further includes a network node configured to communicate with the UE to transmit the user data to the UE from the host.

39. The host of the previous 2 embodiments, wherein:

the processing circuitry of the host is configured to execute a host application, thereby providing the user data; and

the host application is configured to interact with a client application executing on the UE, the client application being associated with the host application.

40. A method implemented by a host operating in a communication system that further includes a network node and a user equipment (UE), the method comprising:

providing user data for the UE; and

initiating a transmission carrying the user data to the UE via a cellular network comprising the network node, wherein the UE performs any of the operations of any of the Group A embodiments to receive the user data from the host.

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41. The method of the previous embodiment, further comprising:

at the host, executing a host application associated with a client application executing on the UE to receive the user data from the host application.

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42. The method of the previous embodiment, further comprising:

at the host, transmitting input data to the client application executing on the UE, the input data being provided by executing the host application,

wherein the user data is provided by the client application in response to the input data from the host application.

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43. A host configured to operate in a communication system to provide an over-the-top (OTT) service, the host comprising:

processing circuitry configured to provide user data; and

20 a network interface configured to initiate transmission of the user data to a cellular network for transmission to a user equipment (UE), wherein the UE comprises a communication interface and processing circuitry, the communication interface and processing circuitry of the UE being configured to perform any of the steps of any of the Group A embodiments to transmit the user data to the host.

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44. The host of the previous embodiment, wherein the cellular network further includes a network node configured to communicate with the UE to transmit the user data from the UE to the host.

45. The host of the previous 2 embodiments, wherein:

30

the processing circuitry of the host is configured to execute a host application, thereby providing the user data; and

the host application is configured to interact with a client application executing on the UE, the client application being associated with the host application.

46. A method implemented by a host configured to operate in a communication system that further includes a network node and a user equipment (UE), the method comprising:

at the host, receiving user data transmitted to the host via the network node by the UE,  
wherein the UE performs any of the steps of any of the Group A embodiments to transmit the  
5 user data to the host.

47. The method of the previous embodiment, further comprising:

at the host, executing a host application associated with a client application executing  
on the UE to receive the user data from the UE.

10

48. The method of the previous 2 embodiments, further comprising:

at the host, transmitting input data to the client application executing on the UE, the  
input data being provided by executing the host application,

wherein the user data is provided by the client application in response to the input data  
15 from the host application.

## REFERENCES

1. R2-2306011 – Discussion on TA handling aspects for LTM, Ericsson, 3GPP TSG-RAN WG2 Meeting#122, Incheon, South Korea, 22nd – 26th May 2023
2. [https://www.3gpp.org/ftp/TSG\\_RAN/WG3\\_Iu/TSGR3\\_121/Docs/R3-233743.zip](https://www.3gpp.org/ftp/TSG_RAN/WG3_Iu/TSGR3_121/Docs/R3-233743.zip)

| Abbreviations | Explanation                             |
|---------------|-----------------------------------------|
| 5GC or 5GCN   | 5G Core Network                         |
| AMF           | Access and Mobility management Function |
| AP            | Application Protocol                    |
| BWP           | Bandwidth Part                          |
| C-RNTI        | Cell Radio Network Temporary Identifier |
| CA            | Carrier Aggregation                     |
| CE            | Control Element                         |
| C-DU          | Candidate DU                            |
| CGI           | Cell Global Identity                    |
| CHO           | Conditional Handover                    |
| CN            | Core Network                            |
| CP            | Control Plane                           |
| CQI           | Channel Quality Indicator               |
| C-RNTI        | Cell Radio Network Temporary Identifier |
| CSI           | Channel State Information               |
| CU            | Central Unit                            |
| CU-CP         | Central Unit Control Plane              |
| CU-UP         | Central Unit User Plane                 |
| DC            | Dual Connectivity                       |
| DCI           | Downlink Control Information            |
| DL            | Downlink                                |
| DRB           | Data Radio Bearer                       |
| DU            | Distributed Unit                        |
| eNB           | (EUTRAN) base station                   |
| E1            | Interface between CU-CP and CU-UP       |

|        |                                                     |
|--------|-----------------------------------------------------|
| F1     | Interface between Central Unit and Distributed Unit |
| FDD    | Frequency Division Duplex                           |
| gNB    | NR base station                                     |
| GTP-U  | GPRS Tunneling Protocol – User Plane                |
| HARQ   | Hybrid ARQ                                          |
| IE     | Information Element                                 |
| IP     | Internet Protocol                                   |
| LTE    | Long Term Evolution                                 |
| LTM    | L1/L2-Triggered Mobility                            |
| MCG    | Master Cell Group                                   |
| MAC    | Medium Access Control                               |
| MAC CE | MAC Control Element                                 |
| MeNB   | Master eNB                                          |
| MgNB   | Master gNB                                          |
| MN     | Master Node                                         |
| MR-DC  | Multi-Radio Dual Connectivity                       |
| NAS    | Non Access Stratum                                  |
| NG-RAN | Next Generation Radio Access Network                |
|        |                                                     |
| NR     | New Radio                                           |
| NR-DC  | NR Dual Connectivity                                |
|        |                                                     |
| PDCP   | Packet Data Convergence Protocol                    |
| PCell  | Primary Cell                                        |
| PCI    | Physical Cell Identity                              |
| PDCCH  | Physical Downlink Control Channel                   |

|        |                                                                    |
|--------|--------------------------------------------------------------------|
| PHR    | Power headroom report                                              |
| PSCell | Primary Secondary Cell (in LTE) or Primary SCG Cell (in NR)        |
| PUCCH  | Physical Uplink Control Channel                                    |
| PUSCH  | Physical Uplink Shared Channel                                     |
| RACH   | Random Access Channel                                              |
| RAT    | Radio Access Technology                                            |
| RB     | Radio Bearer                                                       |
| RLC    | Radio Link Control                                                 |
| RLF    | Radio Link Failure                                                 |
| RRC    | Radio Resource Control                                             |
| RSRP   | Reference Signal Received Power                                    |
| RSRQ   | Reference Signal Received Quality                                  |
| SCell  | Secondary Cell                                                     |
| SCG    | Secondary Cell Group                                               |
| SCTP   | Stream Control Transmission Protocol                               |
| S-DU   | Serving DU                                                         |
| SgNB   | Secondary gNB                                                      |
| SINR   | Signal to Interference plus Noise Ratio                            |
| SN     | Secondary Node                                                     |
| SR     | Scheduling Request                                                 |
| SRB    | Signaling Radio Bearer                                             |
| SSB    | Synchronization Signal Block                                       |
| SpCell | Special Cell, the primary cell of a master or secondary cell group |
| TA     | Timing Advance                                                     |
| TAT    | Time Alignment Timer                                               |

|        |                                          |
|--------|------------------------------------------|
| TCI    | Transmission Configuration Indication    |
| TDD    | Time Division Duplex                     |
| TEID   | Tunnel Endpoint Identifier               |
| TNL    | Transport Network Layer                  |
| T-SN   | Target Secondary Node                    |
| UCI    | Uplink Control Information               |
| UDP    | User Datagram Protocol                   |
| UPF    | User Plane Function                      |
| UE     | User Equipment                           |
| UL     | Uplink                                   |
| UL-SCH | Uplink Shared Channel                    |
| UP     | User Plane                               |
| URLLC  | Ultra Reliable Low Latency Communication |
| X2     | Interface between base stations          |
| Xn     | Interface between base stations          |

COMMUNICATION SYSTEM  
QQ100

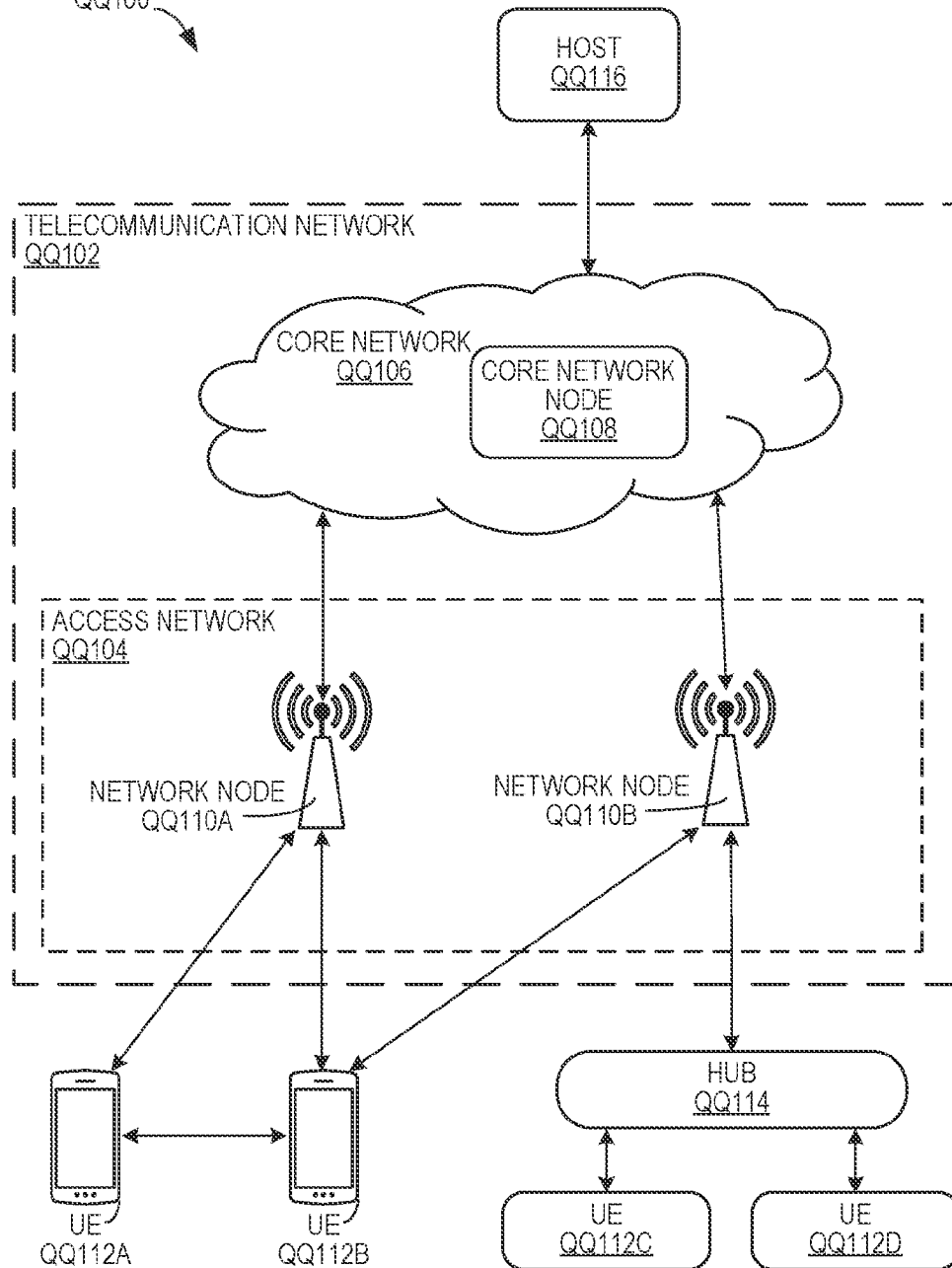


FIG. QQ1

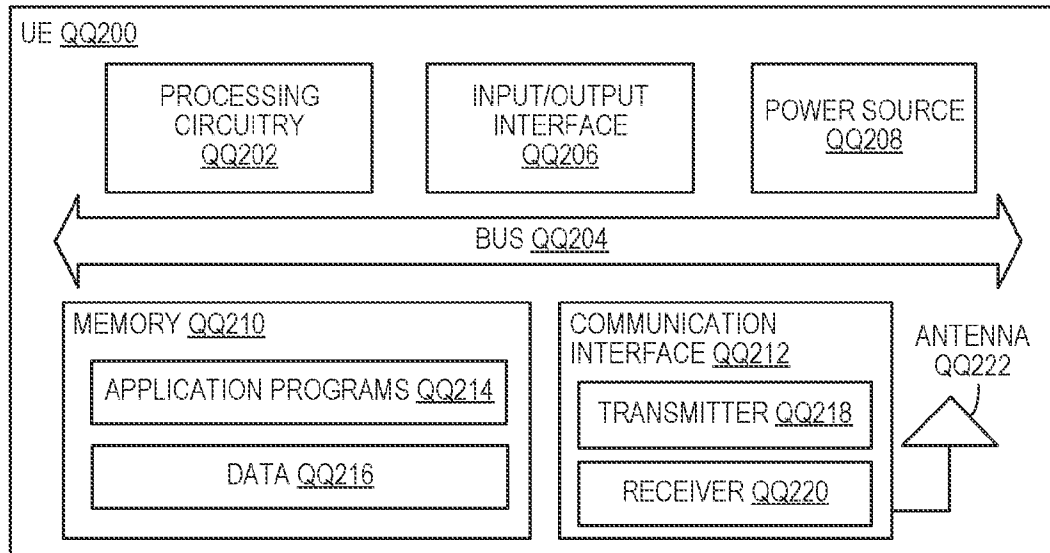


FIG. QQ2

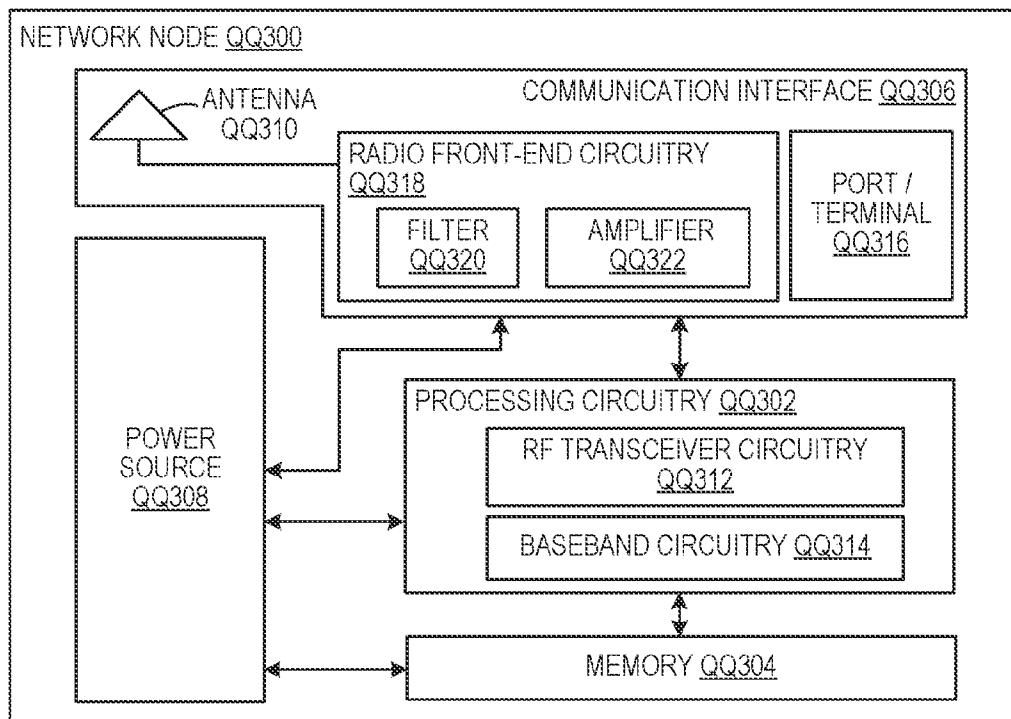


FIG. QQ3

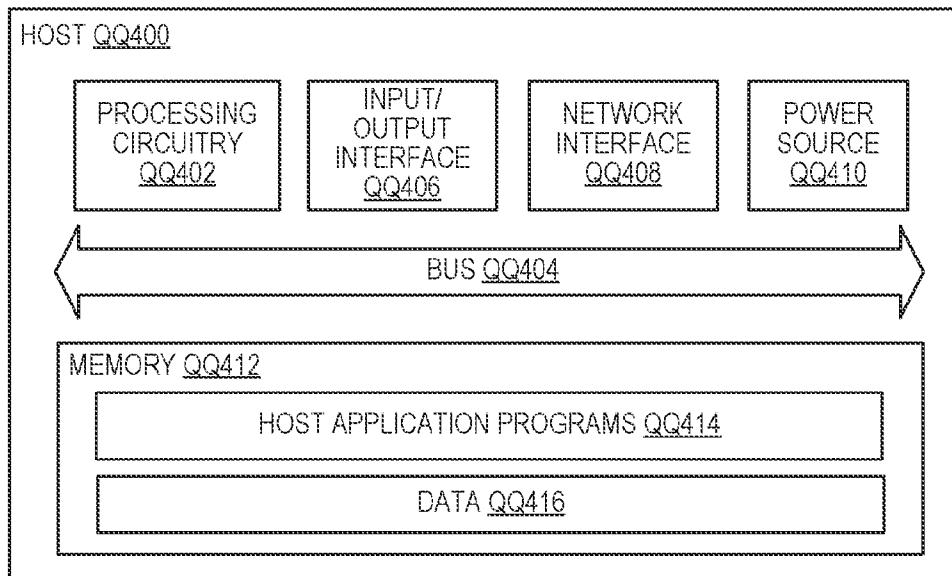


FIG. QQ4

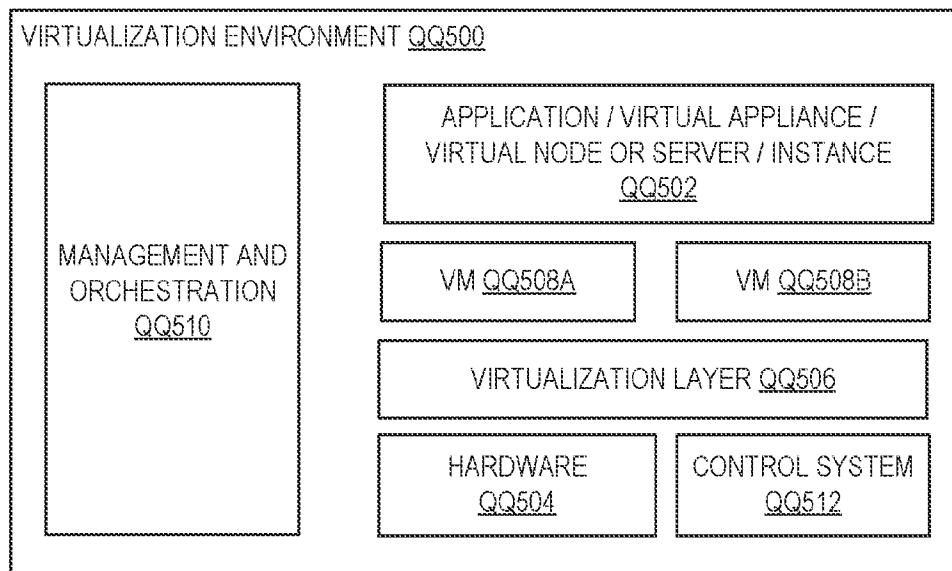


FIG. QQ5

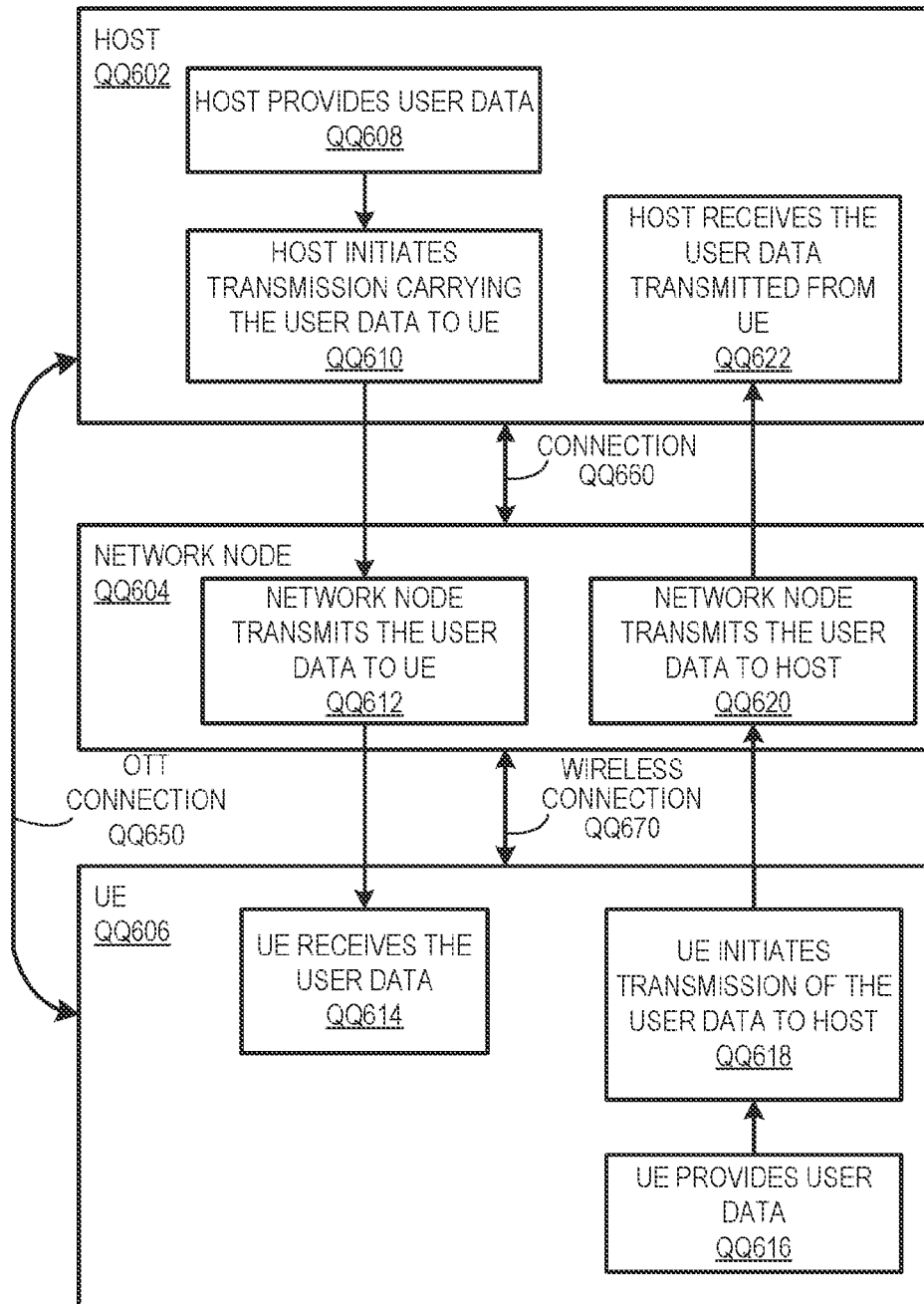


FIG. QQ6