**3GPP TSG-RAN WG2 Meeting #109-e *R2-20xxxxx***

**Online, 24 February - 6 March 2020**

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| *CR-Form-v11.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.300** | **CR** | **TBU** | **rev** | **-** | **Current version:** | **16.0.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **x** | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | Introduction of SON support | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia (rapporteur), Nokia Shanghai Bell, CMCC | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_SON\_MDT-Core | | | | |  | | ***Date:*** | | 2020-02 |
|  |  | | | |  | | |  | |  |
| ***Category:*** | **B** |  | | | | | | ***Release:*** | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduction of NR SON | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Echoing back the RAN3 CR content agreed in R3-197847 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | NR SON is not specified in stage 2. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 15.X (new), 15.X.1 (new), 15.X.2 (new), 15.X.3 (new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | |  | | | |
| ***Other specs*** | |  | **x** | Other core specifications | | |  | | | |
| ***affected:*** | |  | **x** | Test specifications | | |  | | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | |  | | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |

*Start of changes*

# 15 Self-Configuration and Self-Optimisation

## 15.1 Definitions

Void.

## 15.2 Self-optimisation

### 15.X.1 Support for Mobility Load Balancing

*Editor’s note: This section captures the stage 2 descriptions for Mobility Load Balancing*

#### 15.X.1.1 General

*Editor’s note: the content of this section is FFS.*

The objective of mobility load balancing is to distribute cell load evenly among cells or to transfer part of the traffic from congested cell, or to offload users from one cell or carrier or RAT to achieve network energy saving, This can be done by means of optimization of cell reselection/handover parameters and handover actions. The automation of such optimisation can provide high quality user experience, while simultaneously improving the system capacity and also to minimize human intervention in the network management and optimization tasks.

Both intra-RAT and intra-system inter-RAT load balancing scenarios should be supported.

In general, support for mobility load balancing consists of one or more of following functions:

- Load reporting;

- Load balancing action based on handovers;

- Adapting handover and/or reselection configuration.

#### 15.X.1.2 Load reporting

*Editor’s note: the content of this section is FFS.*

The load reporting function is executed by exchanging load information over the Xn/X2/F1/E1 interfaces.

*Editor’s note: load related information and its definition are FFS.*

The following load related information should be supported which consists of,

- Radio resource usage (DL/UL/SUL GBR PRB usage, DL/UL/SUL non-GBR PRB usage, DL/UL/SUL total PRB usage);

- TNL load indicator (UL/DL /SUL TNL load: low, mid, high, overload);

- Cell Capacity Class value (UL/DL relative capacity indicator);

To achieve load reporting function, Resource Status Reporting Initiation & Resource Status Reporting procedures are used.

### 15.X.2 Support for Mobility Robustness Optimization

*Editor’s note: This section captures the stage 2 descriptions for Mobility Robustness Optimization*

*Editor’s note:All message names in this section are FFS.*

#### 15.X.2.1 General

Mobility Robustness Optimisation aims at detecting and enabling correction of following problems:

- Connection failure due to intra-system or inter-system mobility;

- Inter-system Unnecessary HO (too early inter-system HO from NR to E-UTRAN with no radio link failure);

- Inter-system HO ping-pong.

#### 15.X.2.2 Connection failure due to intra-system mobility

One of the functions of Mobility Robustness Optimization is to detect connection failures that occur due to Too Early or Too Late Handovers, or Handover to Wrong Cell. These problems are defined as follows:

- [Intra-system Too Late Handover] An RLF occurs after the UE has stayed for a long period of time in the cell; the UE attempts to re-establish the radio link connection in a different cell.

- [Intra-system Too Early Handover] An RLF occurs shortly after a successful handover from a source cell to a target cell or a handover failure occurs during the handover procedure; the UE attempts to re-establish the radio link connection in the source cell.

- [Intra-system Handover to Wrong Cell] An RLF occurs shortly after a successful handover from a source cell to a target cell or a handover failure occurs during the handover procedure; the UE attempts to re-establish the radio link connection in a cell other than the source cell and the target cell.

In the definition above, the "successful handover" refers to the UE state, namely the successful completion of the RA procedure.

In addition, MRO provides means to distinguish the above problems from NR coverage related problems and other problems, not related to mobility.

The detection of the above events, when involving more than one NG-RAN nodes, is enabled by the Failure Indication and Handover Report procedures.

The Failure Indication procedure may be initiated after a UE attempts to re-establish the radio link connection at NG-RAN node B after a failure at NG-RAN node A. NG-RAN node B may initiate Failure Indication towards multiple NG-RAN nodes if they control cells which use the PCI signalled by the UE during the re-establishment procedure. The NG-RAN node A selects the UE context that matches the received Failure Cell ID and C-RNTI, and, if available, uses the shortMAC-I to confirm this identification, by calculating the shortMAC-I and comparing it to the received IE.

After the RRC re-establishment or RRC connection setup succeed, the UE makes the RLF Report available to the NG-RAN node. The Failure Indication procedure may be initiated after the NG-RAN node fetches the RLF REPORT from UE.

The Handover Report procedure is used in the case of recently completed handovers, when a failure occurs in the target cell (in NG-RAN node B) shortly after it sent the UE Context Release message to the source NG-RAN node A. The Handover Report procedure is also used when an RLF occurs before the UE Context Release message is sent, if the random access procedure in the target cell was completed successfully.

**Detection mechanism:**

The detailed detection mechanisms for too late handover, too early handover and handover to wrong cell are carried out through the following in the NG-RAN node that served the UE before the reported connection failure:

- [Intra-system Too Late Handover]

There is no recent handover for the UE prior to the connection failure e.g. the UE reported timer is absent or larger than the configured threshold (e.g. Tstore\_UE\_cntxt)

- [Intra-system Too Early Handover]

There is a recent handover for the UE prior to the connection failure e.g. the UE reported timer is smaller than the configured threshold (e.g. Tstore\_UE\_cntxt), and the first re-establishment attempt cell/the cell UE attempts to re-connect is the cell that served the UE at the last handover initialisation.

- [Intra-system Handover to Wrong Cell]

There is a recent handover for the UE prior to the connection failure e.g. the UE reported timer is smaller than the configured threshold (e.g. Tstore\_UE\_cntxt), and the first re-establishment attempt cell/the cell UE attempts to re-connect is neither the cell that served the UE at the last handover initialisation nor the cell that served the UE where the RLF happened or the cell that the handover was initialized toward.

The "UE reported timer" above indicates the time elapsed since the last handover initialisation until connection failure.

The detection of the above events, when involving more than one NG-RAN node, is enabled by the Failure Indication and Handover Report procedures. In case of Too Early Handover or Handover to Wrong Cell, the NG-RAN node receiving the FAILURE INDICATION message may use the HANDOVER REPORT message to inform the NG-RAN node controlling the cell where the mobility configuration caused the failure.

**Retrieval of information needed for problem analysis**

The information needed for detailed problem analysis may be retrieved from both, the UE and the network sides. The information that is collected at the UE is provided to the network with the RLF Report, which may be forwarded to the last serving node in the FAILURE INDICATION message and, in case of "Too Early HO" or "HO to Wrong Cell", further in the HANDOVER REPORT message.

In order to retrieve relevant information collected at the network side as part of the UE context, the UE provides C-RNTI used in the last serving cell. If the cause for the failure is identified as a "Too Early HO" or a "HO to Wrong Cell", the NG-RAN node controlling the last serving cell shall, if supported, include in the HANDOVER REPORT message the C-RNTI used in the source cell of the last completed handover before the failure. If the NG RAN node controlling that source cell provided the Mobility Information, it is included in the HANDOVER REPORT message. If used, the Mobility Information is prepared at the source NG RAN node of a handover and may refer to or identify any handover-related data at this NG RAN node.

#### 15.X.2.3 Connection failure due to inter-system mobility

One of the functions of Mobility Robustness Optimization is to detect connection failures that occurred due to Too Early or Too Late inter-system handovers. The UE makes the RLF Report available to the NG-RAN node after reconnecting from idle mode. These problems are defined as follows:

- [Inter-system/ Too Late Handover] An RLF occurs after the UE has stayed in a cell belong to NG-RAN node which connects with 5GC for a long period of time; the UE attempts to re-connect to an E-UTRAN cell which connects with EPC.

- [Inter-system/ Too Early Handover] An RLF occurs shortly after a successful handover from a E-UTRAN cell which connects with EPC to a target cell in a NG-RAN node which connects with 5GC; the UE attempts to re-connect to the source cell or to another E-UTRAN cell which connects with EPC.

The UE makes the RLF Report available to a NG-RAN node, when RLF happens in 5GS and the UE re-connects to a cell belong to an NG-RAN node. Availability of the RLF Report at the RRC connection setup or at a handover to NG-RAN node is the indication that the UE suffered a connection failure and that the RLF Report from this failure was not yet delivered to the network.

The NG-RAN node receiving the RLF Report from the UE may forward the report to the NG-RAN node that served the UE before the reported connection failure using the FAILURE INDICATION message over Xn or by means of the Uplink RAN Configuration Transfer procedure and Downlink RAN Configuration Transfer over NG. If present in the RLF Report, the radio measurements may be used to identify lack of coverage as the potential cause of the failure.

**Detection mechanism:**

Detection mechanisms for Too Late Inter-system Handover and Too Early Inter-system Handover are carried out through the following:

* [Too Late Inter-system Handover]

The connection failure occurs while being connected to a NG-RAN node, and there is no recent handover for the UE prior to the connection failure i.e., the UE reported timer is absent or larger than the configured threshold, e.g., Tstore\_UE\_cntxt, and the first node where the UE attempts to re-connect is a E-UTRAN node which connects with EPC.

* [Too Early Inter-system Handover]

The connection failure occurs while being connected to a NG-RAN node, and there is a recent inter-system handover for the UE prior to the connection failure i.e., the UE reported timer is smaller than the configured threshold, e.g., Tstore\_UE\_cntxt, and the first cell where the UE attempts to re-connect and the node that served the UE at the last handover initialisation are both E-UTRAN node which connects with EPC.

The "UE reported timer" above indicates the time elapsed since the last handover initialisation until connection failure. The UE may make the RLF Report available to an NG-RAN node. The NG-RAN node may forward the information using the FAILURE INDICATION message over Xn or by means of the uplink RAN configuration transfer procedure and downlink RAN configuration transfer over NG to the node that served the UE before the reported connection failure.

In case the failure is a Too Early Inter-system Handover, the NG-RAN node receiving the FAILURE INDICATION message may inform the E-UTRAN node which connects with EPC by means of RAN Configuration Transfer procedure over NG.

#### 15.X.2.4 Inter-system Unnecessary HO

One of the purposes of inter-sytem Mobility Robustness Optimisation is the detection of a non-optimal use of network resources. In particular, in case of inter-system operations and when NR is considered, the case known as Unnecessary HO to another system is identified. The problem is defined as follows:

- UE is handed over from NR to E-UTRAN even though quality of the NR coverage was sufficient for the service used by the UE. The handover may therefore be considered as unnecessary HO to another system (i.e. EPS) (too early inter-sytem HO without connection failure).

In inter-system HO, if the serving cell threshold (NR cell) is set too high, and node in another system (i.e. EPS) with good signal strength is available, a handover to another system may be triggered unnecessarily, resulting in an inefficient use of the networks. With a lower threshold the UE could have continued in the source system (5GS).

To be able to detect the Unnecessary HO to another system, a gNB node may choose to put additional coverage and quality condition information into the HANDOVER REQUIRED message in the Handover Preparation procedure when an inter-system HO from gNB to another system occurs. The RAN node in the other system, upon receiving this additional coverage and quality information, may instruct the UE to continue measuring the node in source system during a period of time, while being connected to another system, and send periodic or single measurement reports to the node in other system. When the period of time indicated by the node in source system expires, the RAN node in the other system, may evaluate the received measurement reports with the coverage/quality condition received during the inter-system HO procedure and decide if an inter-system unnecessary HO report should be sent to the gNB in the source system.

The inter-system unnecessary HO report shall only be sent in cases where, in all UE measurement reports collected during the measurement period, any cells in the source system exceed the radio coverage and/or quality threshold (the radio threshold RSRP or/and RSRQ and the measurement period are indicated in the additional coverage and quality information in the Handover Preparation procedure). If an inter-system handover towards 5GS is executed from EPS within the indicated measurement period, the measurement period expires. In this case, the eNB in EPS may also send the HO Report. No HO Report shall be sent in case no NR cell could be included, or if the indicated period of time is interrupted by an inter-system handover to a system different than 5GS.

The RAN node in the source system (5GS) upon receiving of the report, can decide if/how its parameters (e.g., threshold to trigger Inter-system HO) should be adjusted.

#### 15.X.2.5 Inter-system Ping-pong

One of the functions of Mobility Robustness Optimization is to detect ping-pongs that occur in inter-system environment. The problem is defined as follows:

- A UE is handed over from a cell in a source system (e.g. 5GS) to a cell in a target system different from the source system (e.g. EPS), then within a predefined limited time the UE is handed over back to a cell in the source system, while the coverage of the source system was sufficient for the service used by the UE. The event may occur more than once.

The solution for the problem may consist of the following steps:

1) Statistics regarding inter-system ping-pong occurrences are collected by the responsible node.

2) Coverage verification is performed to check if the mobility to other system was inevitable.

The statistics regarding ping-pong occurrence may be based on evaluation of the *UE History Information* IE in the HANDOVER REQUIRED message. If the evaluation indicates a potential ping-pong case and the source NG\_RAN node of the 1st inter-system handover is different than the target NG-RAN node of the 2nd inter-system handover, the target NG-RAN node may use the HANDOVER REPORT message to indicate the occurrence of potential ping-pong cases to the source NG-RAN node.

If NG-RAN coverage during the potential ping-pong event needs to be verified for the purpose of determining corrective measures, the Unnecessary HO to another RAT procedure may be used

#### 15.X.2.6 O&M Requirements

All automatic changes of the HO and/or reselection parameters for mobility robustness optimisation shall be within the range allowed by OAM.

The following control parameters shall be provided by OAM to control MRO behaviour:

- Maximum deviation of Handover Trigger (FFS)  
 This parameter defines the maximum allowed absolute deviation of the Handover Trigger, from the default point of operation defined by the parameter values assigned by OAM.

- Minimum time between Handover Trigger changes (FFS)  
This parameter defines the minimum allowed time interval between two Handover Trigger change performed by MRO. This is used to control the stability and convergence of the algorithm.

Furthermore, in order to support the solutions for detection of Too Late and Too Early HO, the parameter Tstore\_UE\_cntxt shall be configurable by the OAM system.

*Editor’s note:It is FFS where to capture the definition of the Handover trigger.*

### 15.X.3 Support for RACH Optimization

*Editor’s note: This section captures the stage 2 descriptions for RACH Optimization*