**3GPP TSG-RAN WG2 Meeting #109-e *R2-200XXXX***

**Electronic meeting, 24 February – 6 March, 2020 Revision of R2-2001692**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **38.300** | **CR** | **0186** | **rev** |  **2** | **Current version:** | **16.0.0** |  |
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| *For* [***HELP***](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 SRVCC from 5G to 3G |
|  |  |
| ***Source to WG:*** | Ericsson, China Unicom |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | SRVCC\_NR\_to\_UMTS |  | ***Date:*** | 2020-03-02 |
|  |  |  |  |  |
| ***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 canbe 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)* |
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| ***Reason for change:*** | Introduction of SRVCC from 5G to 3G. |
|  |  |
| ***Summary of change:*** | This CR contains the needed changes to 38.300 for supporting SRVCC from 5G to 3G. |
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| ***Consequences if not approved:*** | SRVCC from 5G to 3G will not be supported in the specifications. |
|  |  |
| ***Clauses affected:*** | 2, 3.1, 9.1, 9.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 38.306 CR 0235 |
| ***affected:*** |  | **X** |  Test specifications | TS 38.331 CR 1446 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS 37.304 CR 0165 |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

Beginning of changes

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

[3] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[4] 3GPP TS 38.401: "NG-RAN; Architecture description".

[5] 3GPP TS 33.501: "Security Architecture and Procedures for 5G System".

[6] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[7] 3GPP TS 38.322: "NR; Radio Link Control (RLC) protocol specification".

[8] 3GPP TS 38.323: "NR; Packet Data Convergence Protocol (PDCP) specification".

[9] 3GPP TS 37.324: " E-UTRA and NR; Service Data Protocol (SDAP) specification".

[10] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in Idle mode and RRC Inactive state".

[11] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".

[12] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[13] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".

[14] 3GPP TS 22.168: "Earthquake and Tsunami Warning System (ETWS) requirements; Stage 1".

[15] 3GPP TS 22.268: "Public Warning System (PWS) Requirements".

[16] 3GPP TS 38.410: "NG-RAN; NG general aspects and principles".

[17] 3GPP TS 38.420: "NG-RAN; Xn general aspects and principles".

[18] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[19] 3GPP TS 22.261: "Service requirements for next generation new services and markets".

[20] 3GPP TS 38.202: "NR; Physical layer services provided by the physical layer"

[21] 3GPP TS 37.340: "NR; Multi-connectivity; Overall description; Stage-2".

[22] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[23] IETF RFC 4960 (2007-09): "Stream Control Transmission Protocol".

[24] 3GPP TS 26.114: "Technical Specification Group Services and System Aspects; IP Multimedia Subsystem (IMS); Multimedia Telephony; Media handling and interaction".

[25] Void.

[26] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

[27] IETF RFC 3168 (09/2001): "The Addition of Explicit Congestion Notification (ECN) to IP".

[28] 3GPP TS 24.501: "NR; Non-Access-Stratum (NAS) protocol for 5G System (5GS)".

[29] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

[30] 3GPP TS 38.415: "NG-RAN; PDU Session User Plane Protocol".

[X] 3GPP TS 23.216: "Single Radio Voice Call Continuity (SRVCC); Stage 2".

Next change

# 3 Abbreviations and Definitions

## 3.1 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1], in TS 36.300 [2] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1] and TS 36.300 [2].

5GC 5G Core Network

5QI 5G QoS Identifier

A-CSI Aperiodic CSI

AKA Authentication and Key Agreement

AMBR Aggregate Maximum Bit Rate

AMC Adaptive Modulation and Coding

AMF Access and Mobility Management Function

ARP Allocation and Retention Priority

BA Bandwidth Adaptation

BCH Broadcast Channel

BPSK Binary Phase Shift Keying

C-RNTI Cell RNTI

CBRA Contention Based Random Access

CCE Control Channel Element

CD-SSB Cell Defining SSB

CFRA Contention Free Random Access

CMAS Commercial Mobile Alert Service

CORESET Control Resource Set

DFT Discrete Fourier Transform

DCI Downlink Control Information

DL-SCH Downlink Shared Channel

DMRS Demodulation Reference Signal

DRX Discontinuous Reception

ETWS Earthquake and Tsunami Warning System

GFBR Guaranteed Flow Bit Rate

I-RNTI Inactive RNTI

INT-RNTI Interruption RNTI

LDPC Low Density Parity Check

MDBV Maximum Data Burst Volume

MIB Master Information Block

MICO Mobile Initiated Connection Only

MFBR Maximum Flow Bit Rate

MMTEL Multimedia telephony

MNO Mobile Network Operator

MU-MIMO Multi User MIMO

NCGI NR Cell Global Identifier

NCR Neighbour Cell Relation

NCRT Neighbour Cell Relation Table

NGAP NG Application Protocol

NR NR Radio Access

P-RNTI Paging RNTI

PCH Paging Channel

PCI Physical Cell Identifier

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PO Paging Occasion

PRACH Physical Random Access Channel

PRB Physical Resource Block

PRG Precoding Resource block Group

PSS Primary Synchronisation Signal

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

PWS Public Warning System

QAM Quadrature Amplitude Modulation

QFI QoS Flow ID

QPSK Quadrature Phase Shift Keying

RA-RNTI Random Access RNTI

RACH Random Access Channel

RANAC RAN-based Notification Area Code

REG Resource Element Group

RIM Remote Interference Management

RMSI Remaining Minimum SI

RNA RAN-based Notification Area

RNAU RAN-based Notification Area Update

RNTI Radio Network Temporary Identifier

RQA Reflective QoS Attribute

RQoS Reflective Quality of Service

RS Reference Signal

RSRP Reference Signal Received Power

RSRQ Reference Signal Received Quality

SD Slice Differentiator

SDAP Service Data Adaptation Protocol

SFI-RNTI Slot Format Indication RNTI

SIB System Information Block

SI-RNTI System Information RNTI

SLA Service Level Agreement

SMC Security Mode Command

SMF Session Management Function

S-NSSAI Single Network Slice Selection Assistance Information

SPS Semi-Persistent Scheduling

SR Scheduling Request

SRS Sounding Reference Signal

SRVCC Single Radio Voice Call Continuity

SS Synchronization Signal

SSB SS/PBCH block

SSS Secondary Synchronisation Signal

SST Slice/Service Type

SU-MIMO Single User MIMO

SUL Supplementary Uplink

TA Timing Advance

TPC Transmit Power Control

UCI Uplink Control Information

UL-SCH Uplink Shared Channel

UPF User Plane Function

URLLC Ultra-Reliable and Low Latency Communications

Xn-C Xn-Control plane

Xn-U Xn-User plane

XnAP Xn Application Protocol

Next change

# 9 Mobility and State Transitions

## 9.1 Overview

Load balancing is achieved in NR with handover, redirection mechanisms upon RRC release and through the usage of inter-frequency and inter-RAT absolute priorities and inter-frequency Qoffset parameters.

Measurements to be performed by a UE for connected mode mobility are classified in at least four measurement types:

- Intra-frequency NR measurements;

- Inter-frequency NR measurements;

- Inter-RAT measurements for E-UTRA;

- Inter-RAT measurements for UTRA.

For each measurement type one or several measurement objects can be defined (a measurement object defines e.g. the carrier frequency to be monitored).

For each measurement object one or several reporting configurations can be defined (a reporting configuration defines the reporting criteria). Three reporting criteria are used: event triggered reporting, periodic reporting and event triggered periodic reporting.

The association between a measurement object and a reporting configuration is created by a measurement identity (a measurement identity links together one measurement object and one reporting configuration of the same RAT). By using several measurement identities (one for each measurement object, reporting configuration pair) it is then possible to:

- Associate several reporting configurations to one measurement object and;

- Associate one reporting configuration to several measurement objects.

The measurements identity is used as well when reporting results of the measurements.

Measurement quantities are considered separately for each RAT.

Measurement commands are used by NG-RAN to order the UE to start, modify or stop measurements.

Handover can be performed within the same RAT and/or CN, or it can involve a change of the RAT and/or CN.

Inter system fallback towards E-UTRAN is performed when 5GC does not support emergency services, voice services, for load balancing etc. Depending on factors such as CN interface availability, network configuration and radio conditions, the fallback procedure results in either RRC\_CONNECTED state mobility (handover procedure) or RRC\_IDLE state mobility (redirection), see TS 23.501 [3] and TS 38.331 [12].

SRVCC from 5G to UTRAN, if supported by both the UE and the network, may be performed to handover a UE with an ongoing voice call from NR to UTRAN. The overall procedure is described in TS 23.216 [X]. See also TS 38.331 [12] and TS 38.413 [26].

In the NG-C signalling procedure, the AMF based on support for emergency services, voice service, any other services or for load balancing etc, may indicate the target CN type as EPC or 5GC to the gNB node. When the target CN type is received by gNB, the target CN type is also conveyed to the UE in *RRCRelease* Message.

Next change

## 9.3 Inter RAT

### 9.3.1 NR-E-UTRA mobility: Intra 5GC

#### 9.3.1.1 Cell Reselection

Cell reselection is characterised by the following:

- Cell reselection between NR RRC\_IDLE and E-UTRA RRC\_IDLE is supported;

- Cell reselection from NR RRC\_INACTIVE to E-UTRA RRC\_IDLE is supported.

#### 9.3.1.2 Handover

Inter RAT mobility is characterised by the following:

- The Source RAT configures Target RAT measurement and reporting.

- The source RAT decides on the preparation initiation and provides the necessary information to the target RAT in the format required by the target RAT:

- For handover preparation from E-UTRA to NR, the source RAT issues a handover preparation request message to the target RAT passing a transparent RRC container with necessary information to prepare the handover at the target side. The information for the target RAT is the same type as specified in section 9.2.3.2.1 including the current QoS flow to DRB mapping applied to the UE and RRM configuration.

- The details of RRM configuration are the same type as specified for NR in section 9.2.3.2.1 including beam measurement information for the listed cells if the measurements are available.

- Radio resources are prepared in the target RAT before the handover.

- The RRC reconfiguration message from the target RAT is delivered to the source RAT via a transparent container, and is passed to the UE by the source RAT in the handover command:

- The inter-RAT handover command message carries the same type of information required to access the target cell as specified for NR baseline handover in section 9.2.3.2.1.

- The in-sequence and lossless handover is supported for the handover between gNB and ng-eNB.

- Both Xn and NG based inter-RAT handover between NG-RAN nodes is supported. Whether the handover is over Xn or CN is transparent to the UE.

- In order to keep the SDAP and PDCP configurations for in-sequence and lossless inter-RAT handover, delta-configuration for the radio bearer configuration is used.

#### 9.3.1.3 Measurements

Inter RAT measurements in NR for this use case are limited to E-UTRA.

For a UE configured with E-UTRA Inter RAT measurements, a measurement gap configuration is always provided when:

- The UE only supports per-UE measurement gaps; or

- The UE supports per-FR measurement gaps and at least one of the NR serving cells is in FR1.

### 9.3.2 NR-E-UTRA mobility: From 5GC to EPC

#### 9.3.2.1 Cell Reselection

Cell reselection is characterised by the following:

- Cell reselection between NR RRC\_IDLE and E-UTRA RRC\_IDLE is supported;

- Cell reselection from NR RRC\_INACTIVE to E-UTRA RRC\_IDLE is supported.

#### 9.3.2.2 Handover and redirection

The source NG-RAN node decides between handover or redirection to EPS based on radio criteria and availability of the N26 interface.

NOTE: Information about the availability of the N26 interface may be configured by OAM at the NG-RAN.

Inter RAT handover is characterised by the following:

- The Source RAT configures Target RAT measurement and reporting.

- The source RAT decides on the preparation initiation and provides the necessary information to the target RAT in the format required by the target RAT.

- Radio resources are prepared in the target RAT before the handover.

- The RRC reconfiguration message from the target RAT is delivered to the source RAT via a transparent container, and is passed to the UE by the source RAT in the handover command.

- In-sequence and lossless handovers are not supported.

- Security procedures for handover to E-UTRA/EPC should follow legacy inter-RAT handover procedures.

#### 9.3.2.3 Measurements

Inter RAT measurements in NR for this use case are limited to E-UTRA.

For a UE configured with E-UTRA Inter RAT measurements, a measurement gap configuration is always provided when:

- The UE only supports per-UE measurement gaps; or

- The UE supports per-FR measurement gaps and at least one of the NR serving cells is in FR1.

#### 9.3.2.4 Data Forwarding for the Control Plane

Control plane handling for inter-System data forwarding from 5GS to EPS follows the following key principles:

- Only forwarding of downlink data is supported.

- PDU session information at the serving NG-RAN node contains mapping information per QoS Flow to a corresponding E-RAB.

- At handover preparation, the source NG-RAN node shall decide which mapped E-RABs are proposed to be subject to data forwarding and provide this information in the source-to-target container to the target eNB. Based on availability of direct data forwarding path the source NG-RAN node may request to apply direct data forwarding by indicating direct data forwarding path availability to the 5GC.

- The target eNB assigns forwarding TEID/TNL address(es) for the E-RAB(s) for which it accepts data forwarding.

- In case of indirect data forwarding, a single data forwarding tunnel is established between the source NG-RAN node and UPF per PDU session for which at least data for a single QoS Flow is subject to data forwarding.

- In case of direct data forwarding, the source NG-RAN node receives a TEID/TNL address for each E-RAB accepted for data forwarding as assigned by the target eNB.

#### 9.3.2.5 Data Forwarding for the User Plane

In case of indirect data forwarding, user plane handling for inter-System data forwarding from 5GS to EPS follows the following key principles:

- For the QoS flows accepted for data forwarding, the NG-RAN node initiates data forwarding to the UPF by the corresponding PDU session data forwarding tunnel(s).

- The UPF maps forwarded data received from the per PDU session data forwarding tunnel(s) to the mapped EPS bearer(s) removing the QFI.

- Handling of end marker packets:

- The source NG-RAN node receives one or several end marker packets per PDU session from the UPF. When there are no more data packets to be forwarded for QoS flows mapped to an E-RAB, the source NG-RAN node sends one or several end markers including one QFI (by means of the PDU Session User Plane protocol TS 38.415 [30]) of those QoS flows mapped to that E-RAB and sends the end marker packets to the UPF over the PDU session tunnel. From the included QFI in the end markers and its mapping to an EPS bearer ID, the UPF knows which EPS bearer tunnel it needs to forward the end-markers to the SGW. The QFI is removed in the end marker packets sent to the SGW.

In case of direct data forwarding, user plane handling for inter-System data forwarding from 5GS to EPS follows the following key principles:

- For the QoS flows accepted for data forwarding, the source NG-RAN node maps data received from the NG-U PDU session tunnel to the respective E-RAB data forwarding tunnel and forwards each user packet as PDCP SDU without PDCP SN and QFI information.

- The source NG-RAN node receives one or several GTP-U end marker packets per PDU session from the UPF and replicates the end marker packets into each E-RAB data forwarding tunnel when no more user data packets are to be forwarded over that tunnel.

### 9.3.3 NR-E-UTRA mobility: From EPC to 5GC

#### 9.3.3.1 Data Forwarding for the Control Plane

Control plane handling for inter-System data forwarding from EPS to 5GS follows the following key principles:

- Only forwarding of downlink data is supported.

- The target NG-RAN node receives in the Handover Request message the mapping between E-RAB ID(s) and QoS Flow ID(s). It decides whether to accept the data forwarding for E-RAB IDs proposed for forwarding within the Source NG-RAN Node to Target NG-RAN Node Transparent Container. Based on availability of direct data forwarding path the source eNB may request to apply direct data forwarding by indicating direct data forwarding availability to the CN.

- In case of indirect data forwarding:

- The target NG-RAN node assigns a TEID/TNL address for each PDU session for which at least one QoS flow is involved in the accepted data forwarding.

- The target NG-RAN node sends the Handover Request Acknowledge message in which it indicates the list of PDU sessions and QoS flows for which it has accepted the data forwarding.

- A single data forwarding tunnel is established between the UPF and the target NG-RAN node per PDU session for which at least data for a single QoS Flow is subject to data forwarding.

- The source eNB receives in the Handover Command message the list of E-RAB IDs for which the target NG-RAN node has accepted data forwarding of corresponding PDU sessions and QoS flows.

- In case of direct data forwarding:

- The source eNB indicates direct path availability to the CN. The source eNB’s decision is indicated by the CN to the target NG-RAN node.

- The target NG-RAN node assigns a TEID/TNL address for each E-RAB it accepted for data forwarding.

- The source eNB receives in the Handover Command message the list of E-RAB IDs for which the target NG-RAN node has accepted data forwarding.

#### 9.3.3.2 Data Forwarding for the User Plane

In case of indirect data forwarding, user plane handling for inter-System data forwarding from EPS to 5GS follows the following key principles:

- For each E-RAB accepted for data forwarding, the source eNB forwards data to the SGW in the corresponding E-RAB tunnel and the SGW forwards the received data to the UPF in the E-RAB tunnel.

- The UPF maps the forwarded data received from an E-RAB tunnel to the corresponding mapped PDU session tunnel, adding a QFI value (by means of the PDU Session User Plane protocol TS 38.415 [30]).

- The target NG-RAN node maps a forwarded packet to the corresponding DRB based on the received QFI value. It prioritizes the forwarded packets over the fresh packets for those QoS flows.

- Handling of end marker packets:

- The UPF/PGW-U sends one or several end marker packets to the SGW per EPS bearer. The SGW forwards the received end markers per EPS bearer to the source eNB. When there are no more data packets to be forwarded for an E-RAB, the source eNB forwards the received end markers in the EPS bearer tunnel to the SGW and the SGW forwards them to the UPF. The UPF adds one QFI (by means of the PDU Session User Plane protocol TS 38.415 [30]) among the QoS flows mapped to that E-RAB to the end markers and sends those end markers to the target NG-RAN node in the per PDU session tunnel. When the target NG-RAN node receives an end marker with a QFI added, the target NG-RAN node starts to transmit the data packets of all QoS flows mapped to the corresponding E-RAB received from the core network towards the UE.

In case of direct data forwarding, user plane handling for inter-System data forwarding from EPS to 5GS follows the following key principles:

- For each E-RAB accepted for data forwarding, the source eNB forwards data to the target NG-RAN node in the corresponding E-RAB data forwarding tunnel.

- Until a GTP-U end marker packet is received, the target NG-RAN node prioritizes the forwarded packets over the fresh packets for those QoS flows which are involved in the accepted data forwarding.

### 9.3.x NR-UTRA mobility

#### 9.3.x.1 Handover with SRVCC operation

The source NR node decides to handover the UE with ongoing IMS voice from NR to UTRAN according the following principles:

- The source NR node configures target RAT measurement and reporting;

- The source NR node determines based on the radio conditions and the indication that SRVCC operation is possible that handover to UTRAN should be initiated;

- The source NR node initiates the handover preparation only for the ongoing IMS voice and provides the indication to AMF that the handover is towards UTRAN together with the target UTRAN Node ID. The source NR node also provides an indication to the target UTRAN that the incoming handover originates from 5G.The SRVCC proceeds as specified in TS 23.216 [X];

- Radio resources are prepared in the target RAT before the handover;

- The RRC reconfiguration message from the target RAT is delivered to the source NR node via a transparent container and is passed to the UE by the source NR node in the handover command;

- In-sequence and lossless handovers are not supported;

- Only voice bearer is handed over to target RAT;

- Security procedures for handover to UTRA follows the procedures as specified in TS 33.501 [5];

- Only handover to UTRA-FDD is supported.

#### 9.3.x.2 Measurements

Inter RAT measurements are performed for UTRA.

End of changes