5G NR NSA 3X Mobility Procedure

TP00005-V-1701 V0 - S05M04 Ed1

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3GPP TS 37.340 Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity

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Learning objectives
Upon completion of this module, you should be able to:

Describe NSA 3x SCG mobility procedures
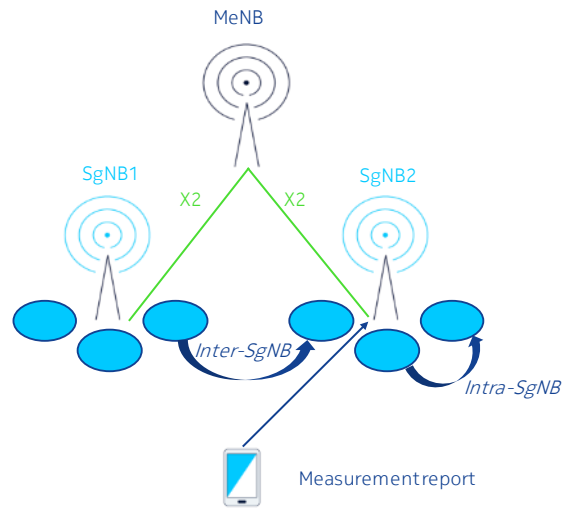Describe NSA 3x MCG mobility procedures

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NSA 3x Mobility Scenario

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SCG mobility

Intra SgNB PSCell change:
Mobility occurs within the same SgNB

Inter SgNB PSCell change :
Mobility occurs between cells of different SgNB

MeNB

SgNB1   SgNB2

X2   X2

Inter-SgNB

Intra-SgNB

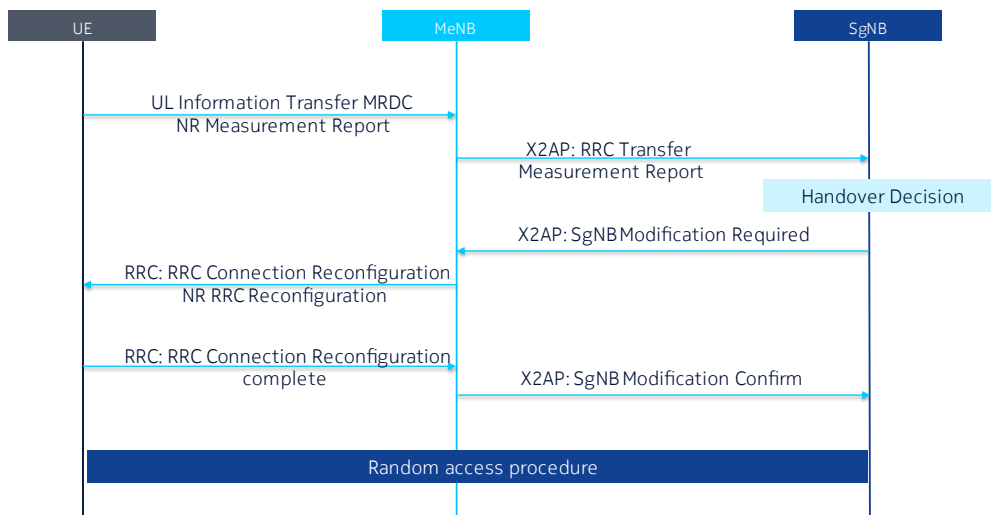Measurement report

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MCG mobility

Intra-MeNB handover with/without Secondary Node change

Inter-MeNB handover with/without Secondary Node change:

handover occurs between LTE cells distributed by two MeNBs

SgNB

MeNB1   MeNB2

X2   X2

X2

Inter-MeNB   Intra-MeNB

Measurement report

SCG Mobility Procedure

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Intra-SgNB Handover (Without SRB3)

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RRC Signaling towards UE is done through MCG SRB1 (tunneled through MeNB and X2-C)

NR HO decision

• SgNB receives RRC NR measurement report from MeNB via *X2 RRC Transfer*

NR Handover Preparation

• SgNB selects the best target PSCell and prepares target cell for PSCell change
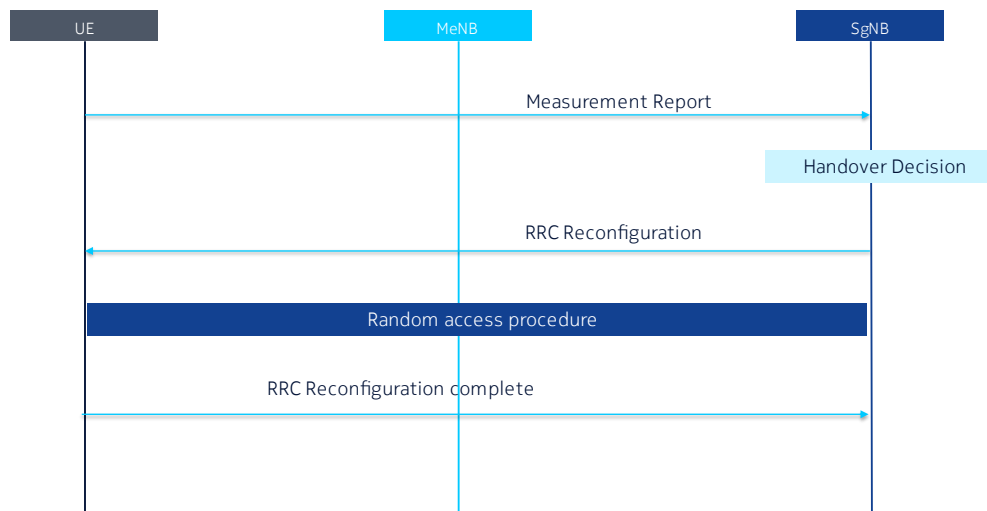
• **NR Handover Execution**

• SgNB initiates NR RRC Reconfiguration to MeNB via *X2 SgNB Modification* procedure to execute the PSCell change

• UE performs RACH procedure to access the target PSCell, the target PSCell resumes DL/UL data transfer

NR Handover Completion

• SgNB release the UE context at source pscell.

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Intra-SgNB Handover (With SRB3)

UE — MeNB — SgNB

Measurement Report →

Handover Decision

← RRC Reconfiguration

Random access procedure

RRC Reconfiguration complete →

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RRC Signaling towards UE is done through SCG SRB3

NR HO decision
- SgNB receives RRC NR measurement report

NR Handover Preparation
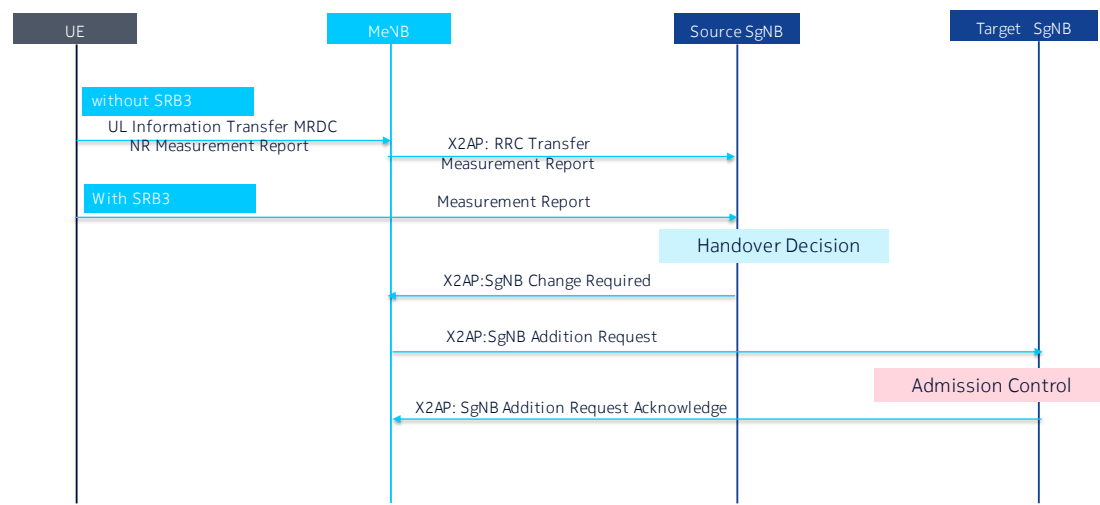- SgNB selects the best target PSCell and prepares target cell for PSCell change
- **NR Handover Execution**
- SgNB Sends NR RRC Reconfiguration to UE through SRB3
- UE performs RACH procedure to access the target PSCell, the target PSCell resumes DL/UL data transfer

NR Handover Completion
- Upon RRC Reconfiguration Complete received in the target PSCell, SgNB releases the UE context at source PSCell.

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Inter-SgNB Handover (1/2)

UE | MeNB | Source SgNB | Target SgNB

without SRB3

UL Information Transfer MRDC
NR Measurement Report

X2AP: RRC Transfer
Measurement Report

With SRB3

Measurement Report

Handover Decision

X2AP:SgNB Change Required

X2AP:SgNB Addition Request

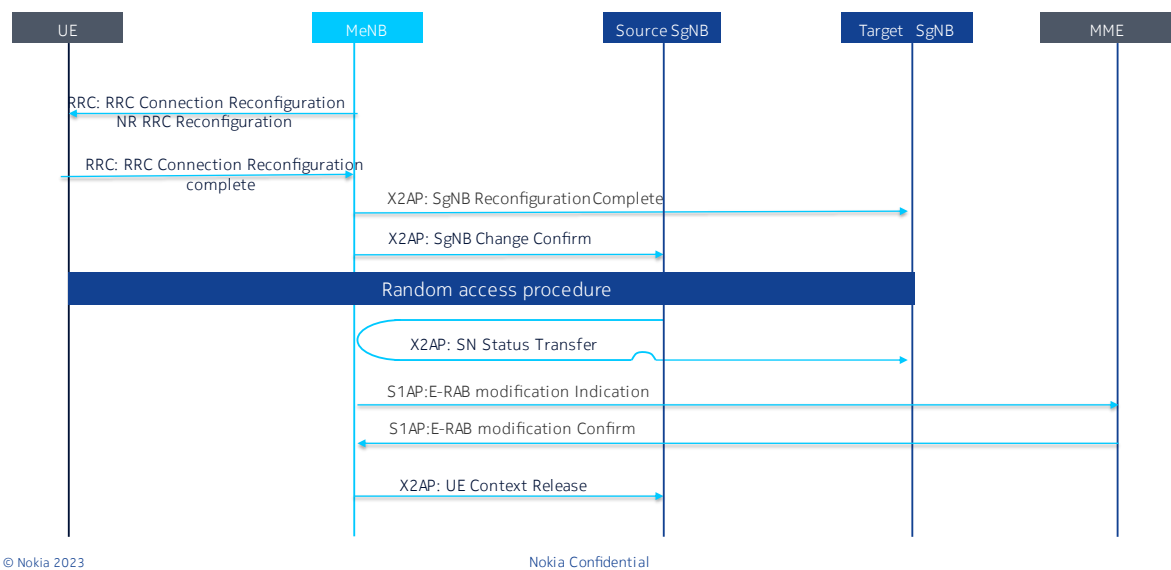Admission Control

X2AP: SgNB Addition Request Acknowledge

NR HO decision

- Source SgNB receives RRC NR measurement report (through SRB3 or MeNB)
- Source SgNB selects the best target PSCell and determines this is an inter SgNB target cell

NR Handover Preparation

- Source SgNB triggers a *X2 SgNB change* procedure towards the MeNB
- MeNB prepares target cell on target SgNB for PSCell change via *X2 SgNB Addition Request.*
- Context is setup on target, target SgNB acknowledges the SgNB Addition procedure to MeNB via **X2AP: SgNB Addition acknowledge**

Inter-SgNB Handover (2/2)

UE	MeNB	Source SgNB	Target SgNB	MME

RRC: RRC Connection Reconfiguration
NR RRC Reconfiguration

RRC: RRC Connection Reconfiguration complete

X2AP: SgNB Reconfiguration Complete

X2AP: SgNB Change Confirm

Random access procedure

X2AP: SN Status Transfer

S1AP: E-RAB modification Indication

S1AP: E-RAB modification Confirm

X2AP: UE Context Release
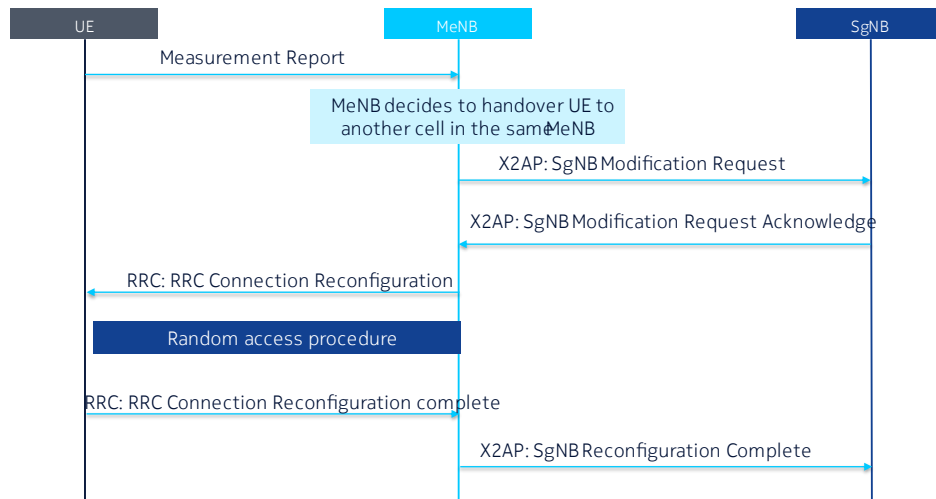
NR Handover Execution

- Target SgNB sends a RRC Reconfiguration via MeNB SRB to execute the en-gNB
- Source SgNB triggers the *X2 SN Status transfer* to transfer via MeNB the PDCP SN and HFN status of each E-RAB to the target en-gNB and applies DL data forwarding
- UE performs RACH procedure to access the target PSCell, the target PSCell resumes DL/UL data transfer

NR Handover Completion

- MeNB release the UE context at source SgNB via *X2 UE Context Release* procedure

MCG Mobility Procedure

Intra MeNB Handover

LTE HO decision

• LTE MeasurementReport triggers the LTE handover

LTE Handover Preparation

• MeNB triggers a *X2 SgNB Modification* procedure at the SgNB. SgNB accepts the request and prepares for the handover and replies to MeNB with X2AP: SgNB Modification Request Acknowledge.
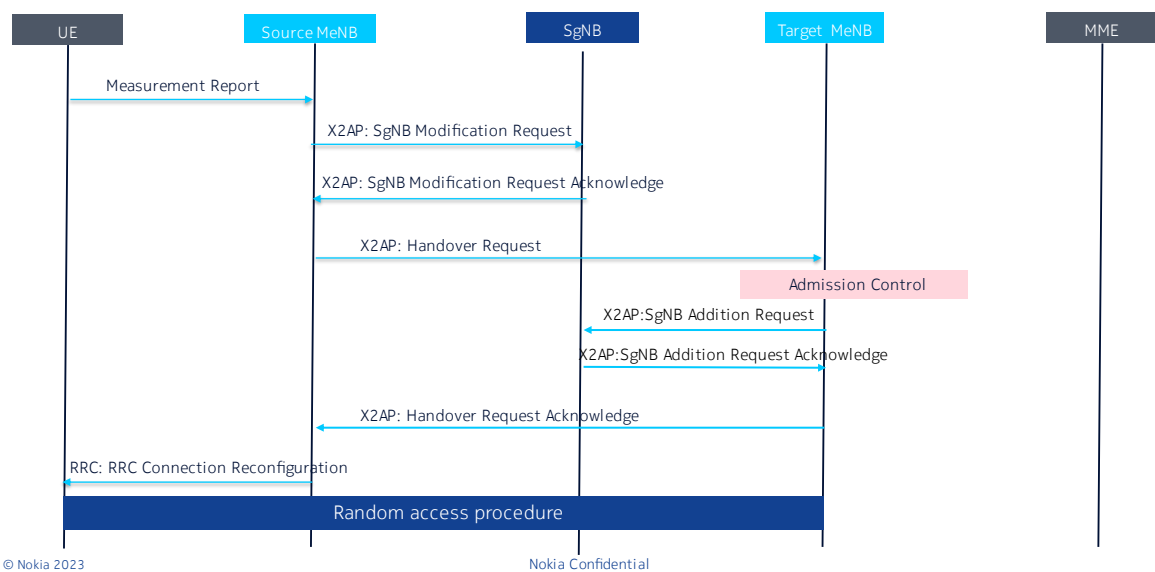
LTE Handover Execution

• MeNB sends RRC: Connection Reconfiguration message to the UE.
• UE performs Random Access procedure in the target PCell (MeNB).

Handover completion

• MeNB notifies SgNB about successful UE reconfiguration via **X2AP: SgNB Reconfiguration Complete** message.

Inter MeNB Handover (X2-based 1/2)

| UE | Source MeNB | SgNB | Target MeNB | MME |

- Measurement Report
- X2AP: SgNB Modification Request
- X2AP: SgNB Modification Request Acknowledge
- X2AP: Handover Request
- Admission Control
- X2AP: SgNB Addition Request
- X2AP: SgNB Addition Request Acknowledge
- X2AP: Handover Request Acknowledge
- RRC: RRC Connection Reconfiguration
- Random access procedure

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LTE HO decision

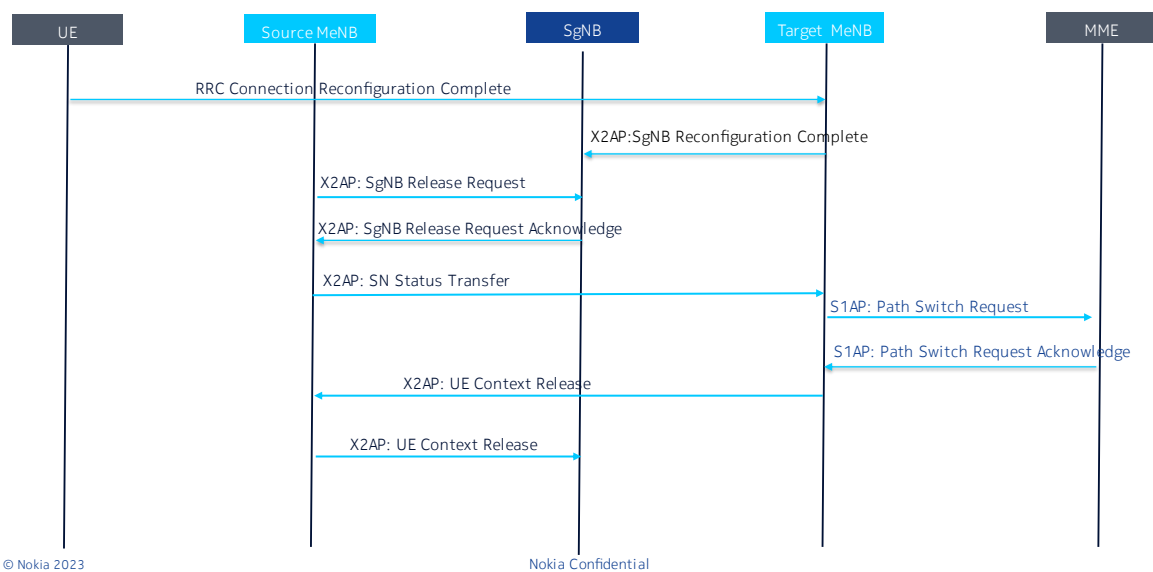- MeasurementReport triggers the LTE handover

LTE Handover Preparation

- Source MeNB sends SgNBModificationRequest with SCG Configuration Query to SgNB. SgNB responds with SgNBModificationRequest Acknowledge.
- Source MeNB sends Handover Request to Target MeNB
- target MeNB decides if HO can be accepted and all the SCG split bearers can be maintained.
- If SCG split bearers can be kept, target MeNB sends SgNBAddition Request to SgNB.
- target MeNB sends Handover Request ACK to Source MeNB

LTE Handover Execution
- MeNB sends RRC: Connection Reconfiguration message to the UE.
- UE performs Random Access procedure in the target PCell (MeNB).

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Inter MeNB Handover (X2-based 2/2)

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- MeNB notifies SgNB about successful UE reconfiguration via **X2AP: SgNB Reconfiguration Complete** message.
- Source MeNB sends SgNB Release Request to SgNB with RNL cause: MCG Mobility, UE Context Kept Indicator. SgNB responses with SgNB Release Request Acknowledge which is ignored by Source MeNB.
- S1AP: Patch Switch Request is sent from Target MeNB to MME, which initiates User Plane Update and DL Path Switch. MME replies with S1AP: Patch Switch Request Acknowledge.

- The last step is UE Context release. X2AP: UE Context Release message is sent from Target to Source MeNB and then to SgNB. Upon reception of the UE Context Release message, the (source) SN releases C-plane related resources associated to the UE context towards the source MN. Any ongoing data forwarding may continue. The SN shall not release the UE context associated with the target MN if the UE context kept indication was included in the SgNB Release Request message

Wrap-up
In this module we have covered the following items

Describe NSA 3x SCG mobility procedures
Describe NSA 3x MCG mobility procedures

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