LTE X2 Handover Messaging

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LTE X2 Handover Sequence Diagram

- **UE**
- **Target eNodeB**
- **Source eNodeB**
- **MME**
- **SGW**

1. **X2AP Handover Request** from Target eNodeB to Source eNodeB
2. **X2AP Handover Request Acknowledge** from Source eNodeB to Target eNodeB
3. **Handover Command** from Source eNodeB to Target eNodeB
4. **X2AP SN Transfer Status** from Target eNodeB to Source eNodeB
5. **S1AP Path Switch Request** from Source eNodeB to MME
6. **S1AP Path Switch Acknowledge** from MME to Source eNodeB
7. **X2AP UE Context Release** from Source eNodeB to Target eNodeB
8. **Tracking Area Update Request** from Target eNodeB to SGW
9. **Tracking Area Update Response** from SGW to Target eNodeB
10. **Begin forwarding downlink data from source to destination eNodeB**
11. **Modify Bearer Request** from Source eNodeB to MME
12. **Modify Bearer Response** from MME to Source eNodeB
13. **Modify Bearer Request** from MME to SGW
14. **Modify Bearer Response** from SGW to MME
15. **Marks the end for forwarding**

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Source eNodeB ➔ Target eNodeB

X2AP Handover Request

- eNodeB decides to initiate an X2 handover based on:
  - UE reported RRC downlink signal quality measurements
  - Uplink signal quality measured at the eNodeB
- eNodeB picks the target cell id for the handover.
- X2 handover is initiated if the If the target cell is served by the same MME as the current cell
- The message includes UE context information that identifies the UE on the S1AP interface.
  - Security parameters are also included in the message
- Information about the radio bearers is included in the message. The per RAB information includes
  - QoS parameters
  - GTP Tunnel Information
- The message also includes RRC context information
Target eNodeB →
Source eNodeB

X2AP Handover Request Acknowledge

- The target eNodeB receives performs admission control on receipt of the Handover Request.
- The target eNodeB responds with X2AP Handover Request Acknowledge.
- Information about the accepted RABs is included in the message.
  - The Uplink and Downlink GTP Tunnel information is included for each RAB.
  - The tunnel assignments are made at the target to transport traffic during the handover.
- A Handover Command message sent via a transparent container.
  - The source eNodeB send this message to the UE.
Source eNodeB ➔
Target eNodeB

X2AP SN Transfer Status

• The source eNodeB now sends the SN Transfer Status
• The following fields are present for each RAB
  • The uplink PDCP sequence number
  • Uplink Hyper Frame Number
  • The downlink PDCP sequence number
  • Downlink Hyper Frame Number
• These fields are needed for continuing ciphering and integrity protection after the handover.
Target eNodeB → MME
S1AP Path Switch Request

- The target eNodeB requests switching of the S1-U GTP tunnel towards the target eNodeB.
- The MME identifies the UE with the “eNB to UE S1AP ID”
- The message includes the new cell id and the tracking area id
- Security capabilities of the target eNodeB are also included.
**MME → SGW**

**Modify Bearer Request**

- The MME requests the SGW to switch the path to the target eNodeB.
- The S1-U TEID received from the target eNodeB is passed to the SGW.
SGW → MME

Modify Bearer Response

- SGW updates the bearer and responds back
S1AP: MME → Target eNodeB

S1AP Path Switch

Acknowledgment

- The target eNodeB requests switching of the S1-U GTP tunnel towards the target eNodeB.
- The MME identifies the UE with the “eNB to UE S1AP ID”
- The message includes the new cell id and the tracking area id
- Security capabilities of the target eNodeB are also included.
Target eNodeB ➔ Source eNodeB

X2AP UE Context Release

- Sent when the target eNodeB has successfully completed the path switching and radio signaling for the handover.
UE-NAS → MME-NAS
Tracking Area Update Request

- Sent if the just completed handover resulted in a Tracking Area Update
MME-NAS → UE-NAS

Tracking Area Update

Accept

- Sent if the just completed handover resulted in a Tracking Area Update
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