LTE系统全网信令流程

Introduction

As a new wireless mobile communication technology, LTE (Long Term Evolution) provide all kinds of services through network access procedures. So when you are trying to understand the LTE technology, the network access procedure is just in the close front of your eyes.

This document is trying to describe the general procedure handlings among the network elements under LTE network architecture, by way of showing you the procedure handlings in figures. From these figures, you will get an overview of the LTE general procedures, such as: “The System Information Handling”, “The Random Access Procedure”, “The Attach Procedure”, “The TAU Procedure”, “The Handover Procedure”, etc.

The first several figures show the introduction of protocol layer stacks among network elements, such as: protocol layer stacks“between UE-MME”, “between UE-PDN GW”, etc. From these protocol layer stacks introduction, you will learn the peer-to-peer protocol layers among several related network elements, it will help you to understand LTE procedures’ working mechanism stuff. And after, begins the description of the LTE general procedure, in an order from “System information handling”to “ANR Measurement procedure”, with the “access procedure”, “handover procedure”, “inter-RAT operation procedure”,……, in the middle. From these procedure figures description, you can get the deep details of the LTE network access procedure, and it will finally direct you to found a whole-system-view of LTE architecture.

This document is suitable for the guys who want to know the LTE general procedure, or use it as a reference book.

2009-11-06

LTE PDU L3 R&D Team

Abbreviations

MME	Mobility Management Entity
UE	User Equipment
MS	Mobile Station
eNodeB	evolved NodeB
GW	GateWay
PCRF	Policy and Charging Rules Fuction
H-PCRF	Home-PCRF
V-PCRF	Visited-PCRF
HSS	Home Subscriber Server
EIR	Equipment Identity Register
UTRAN	Universal Terrestrial Radio Access Network
E-UTRAN	evolved UTRAN
GERAN	GSM/EDGE Radio Access Network
PLMN	Public Land Mobile Network
HPLMN	Home PLMN
VPLMN	Visited PLMN
HLR	Home Location Register
VLR	Visitor Location Register
CBC	Cell Broadcast Centre
OMC	Operation and Maintenance Center
BSC	Base Station Controler
BTS	Base Transceiver Station
BSS	Base Station Subsystem
CN	Core Network
MSC/SGSN	Mobile-services Switching Centre/Serving GPRS Support Node
Inter-RAT	Radio Access Technology
MBMS	Media Broadcast and Multicast System
MCE	Multi-cell/multicast Coordination Entity
RNC	Radio Network Controler

Network elements functions

eNodeB functions:

- Header compression and user plane ciphering;
- MME selection when no routeing to an MME can be determined from the information provided by the UE;
- UL bearer level rate enforcement based on UE-AMBR and MBR via means of uplink scheduling (e.g. by limiting the amount of UL resources granted per UE over time);
- DL bearer level rate enforcement based on UE-AMBR;
- UL and DL bearer level admission control;
- Transport level packet marking in the uplink, e.g. setting the DiffServ Code Point, based on the QCI of the associated EPS bearer.

MME functions:

- NAS signalling;
- NAS signalling security;
- Inter CN node signalling for mobility between 3GPP access networks (terminating S3);
- UE Reachability in ECM-IDLE state (including control and execution of paging retransmission);
- Tracking Area list management;
- PDN GW and Serving GW selection;
- MME selection for handovers with MME change;
- SGSN selection for handovers to 2G or 3G 3GPP access networks;
- Roaming (S6a towards home HSS);
- Authentication;
- Authorization;
- Bearer management functions including dedicated bearer establishment;
- Lawful Interception of signalling traffic;
- Warning message transfer function (including selection of appropriate eNB);
- UE Reachability procedures.

SGSN functions:

- Inter EPC node signalling for mobility between 2G/3G and E-UTRAN 3GPP access networks;
- PDN and Serving GW selection: the selection of S−GW/P−GW by the SGSN is as specified for the MME;
- MME selection for handovers to E-UTRAN 3GPP access network.

Network elements functions

Serving GW functions:

- the local Mobility Anchor point for inter-eNodeB handover;
- sending of one or more "end marker" to the source eNodeB, source SGSN or source RNC immediately after switching the path during inter-eNodeB and inter-RAT handover, especially to assist the reordering function in eNodeB.
- Mobility anchoring for inter-3GPP mobility (terminating S4 and relaying the traffic between 2G/3G system and PDN GW);
- ECM-IDLE mode downlink packet buffering and initiation of network triggered service request procedure;
- Lawful Interception;
- Packet routeing and forwarding;
- Transport level packet marking in the uplink and the downlink, e.g. setting the DiffServ Code Point, based on the QCI of the associated EPS bearer;
- Accounting for inter-operator charging. For GTP-based S5/S8, the Serving GW generates accounting data per UE and bearer;
- Interfacing OFCS according to charging principles and through reference points specified in TS 32.240 [51].

PDN GW functions:

- Per-user based packet filtering (by e.g. deep packet inspection);
- Lawful Interception;
- UE IP address allocation;
- Transport level packet marking in the uplink and downlink, e.g. setting the DiffServ Code Point, based on the QCI of the associated EPS bearer;
- Accounting for inter-operator charging;
- UL and DL service level charging as defined in TS 23.203 [6]
  (e.g. based on SDFs defined by the PCRF, or based on deep packet inspection defined by local policy);
- Interfacing OFCS through according to charging principles and through reference points specified in TS 32.240 [51].
- UL and DL service level gating control as defined in TS 23.203 [6];
- UL and DL service level rate enforcement as defined in TS 23.203 [6]
  (e.g. by rate policing/shaping per SDF);
- UL and DL rate enforcement based on APN-AMBR
  (e.g. by rate policing/shaping per aggregate of traffic of all SDFs of the same APN that are associated with Non-GBR QCIs);

- DL rate enforcement based on the accumulated MBRs of the aggregate of SDFs with the same GBR QCI
  (e.g. by rate policing/shaping);
- DHCPv4 (server and client) and DHCPv6 (client and server) functions;
- The network does not support PPP bearer type in this version of the specification. Pre-Release 8 PPP functionality of a GGSN may be implemented in the PDN GW;
- packet screening.
- UL and DL bearer binding as defined in TS 23.203 [6];
- UL bearer binding verification as defined in TS 23.203 [6];
- Functionality as defined in RFC 4861 [32];
- Accounting per UE and bearer.

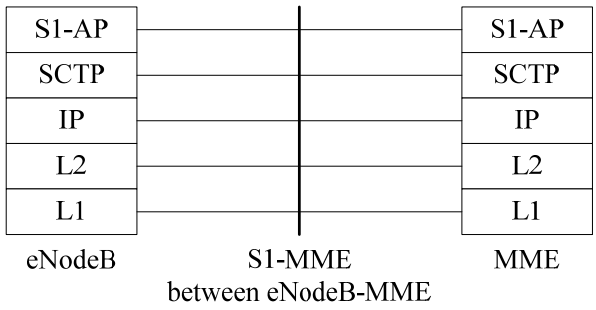
H-PCRF functions:

- terminates the Rx reference point for home network services;
- terminates the S9 reference point for roaming with local breakout;
- associates the sessions established over the multiple reference points (S9, Rx), for the same UE's IP-CAN session (PCC session binding).

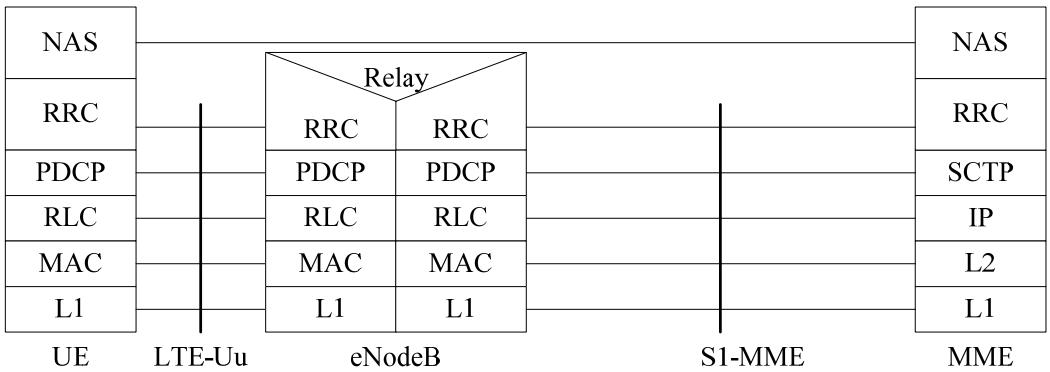
V-PCRF functions:

- terminates the Gx and S9 reference points for roaming with local breakout;
- terminates Rx for roaming with local breakout and visited operator's Application Function.

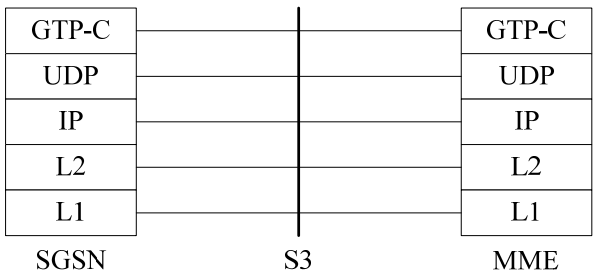
网元间信令面总体协议栈



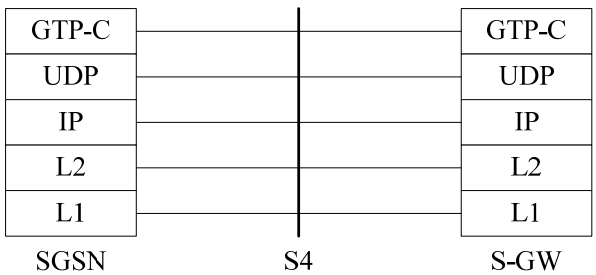
between eNodeB-MME



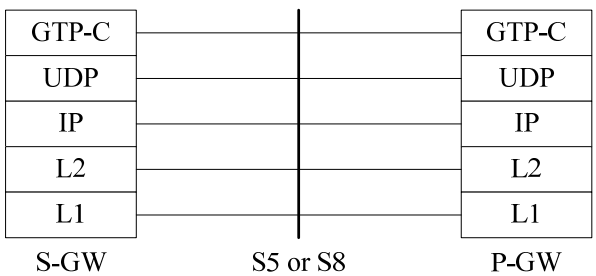
between UE-MME



between SGSN-MME

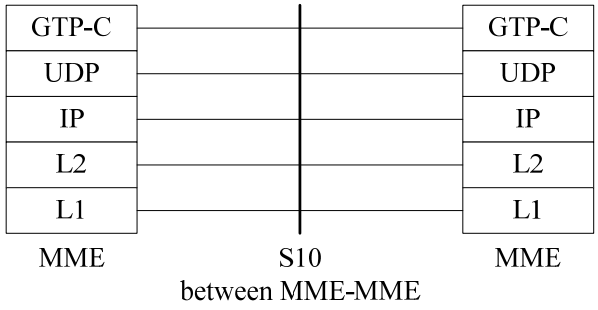


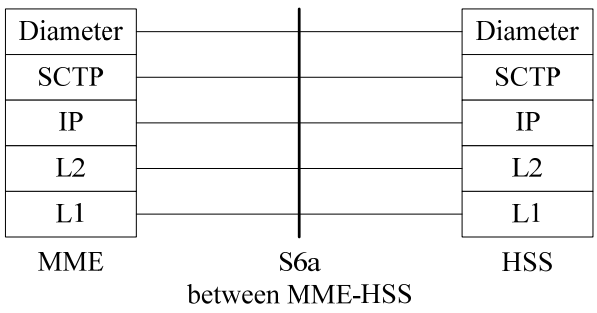
between SGSN-Serving GW

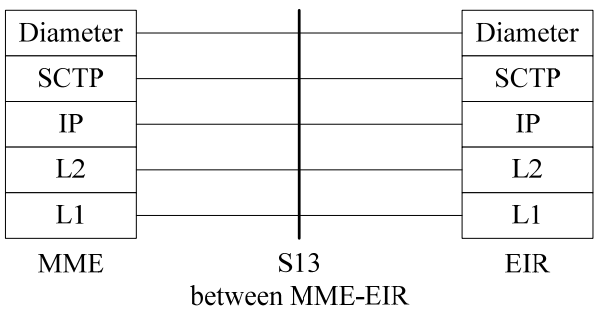


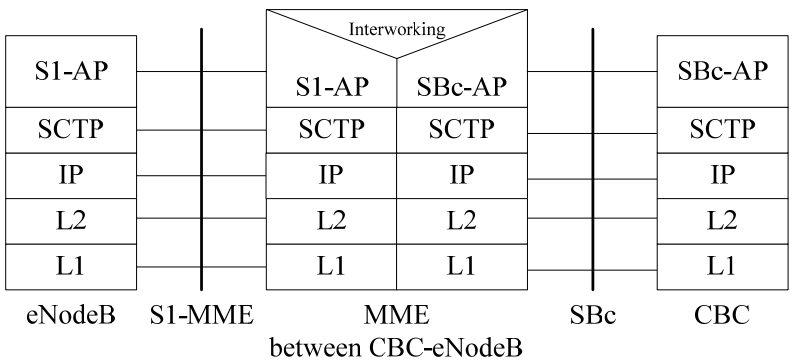
between Serving GW-PDN GW

网元间信令面总体协议栈（续）

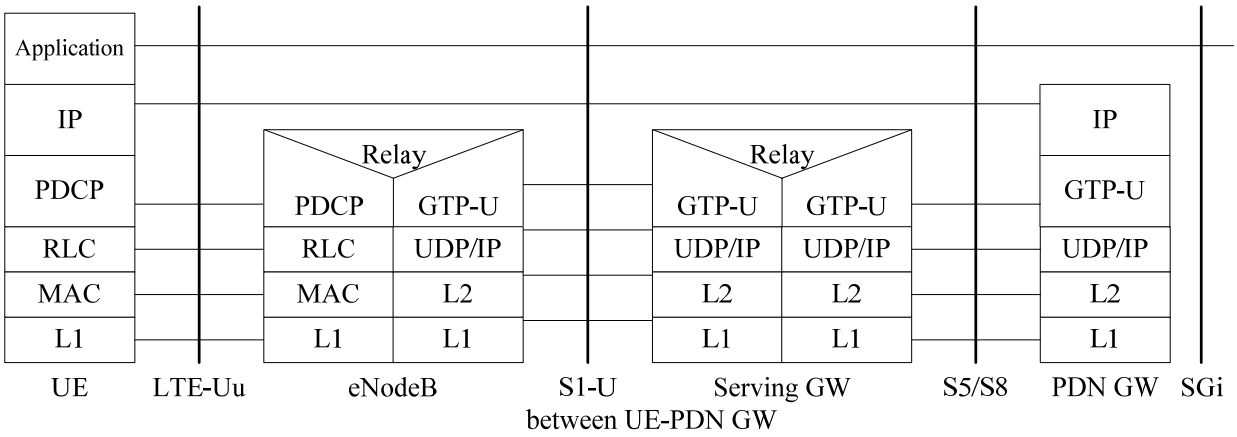




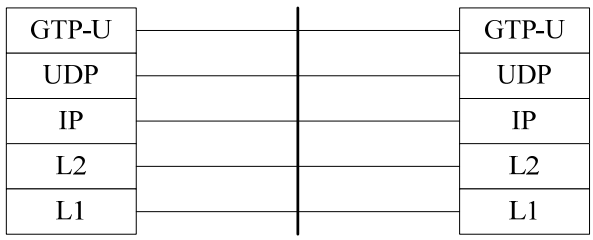




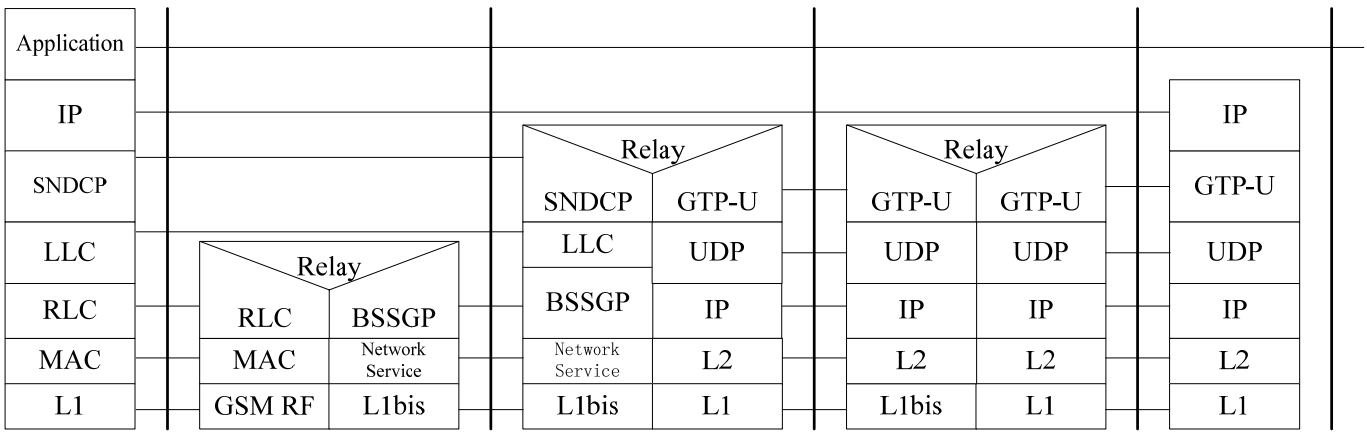
网元间用户面总体协议栈



between UE-PDN GW

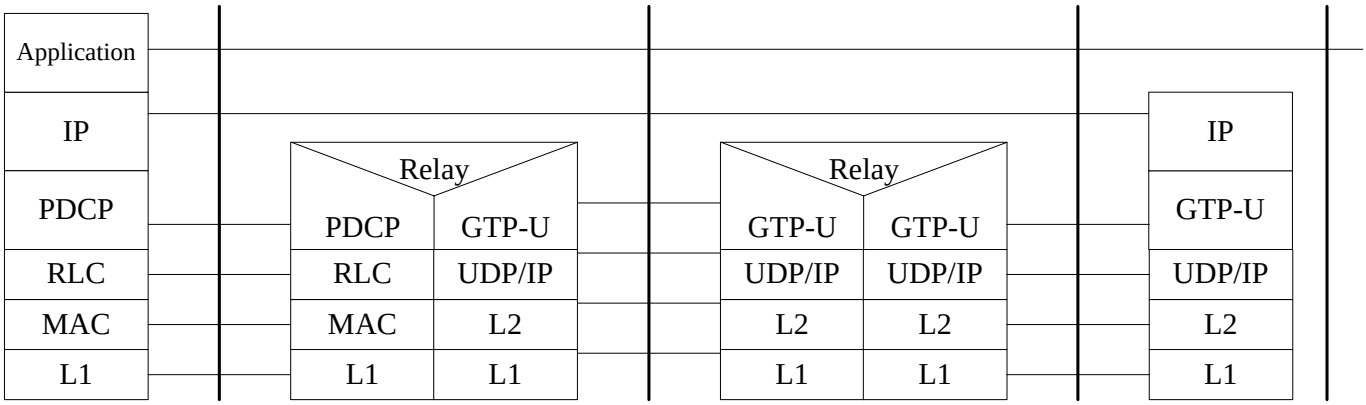


between eNodeB-Serving GW

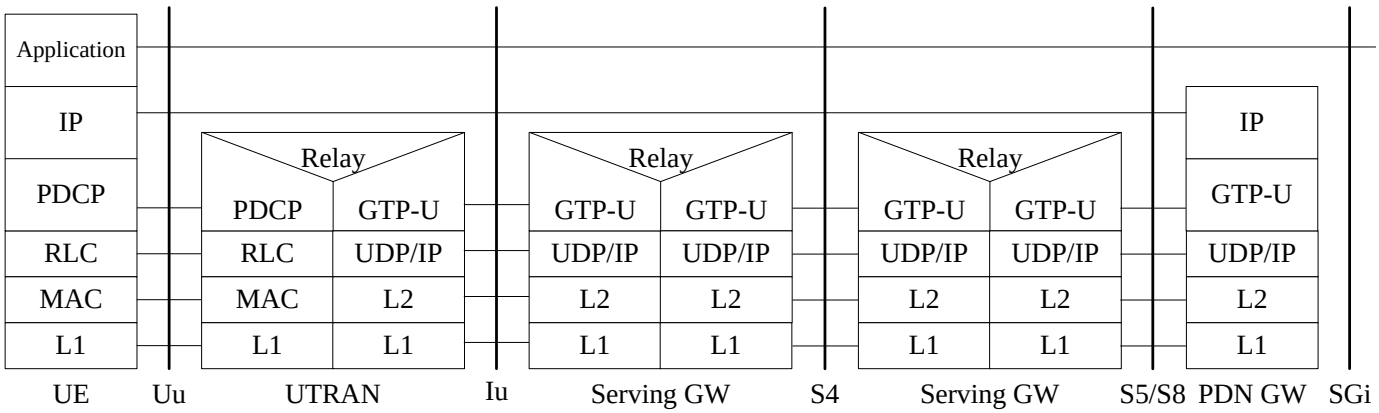


between UE-PDN GW with 2G access via S4

网元间用户面总体协议栈（续）

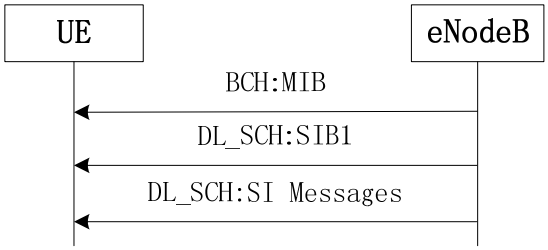


between UE-PDN GW with 3G access via S12



between UE-PDN GW with 3G access via S12

系统消息广播流程



Special comments:

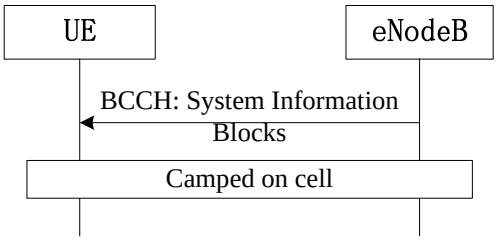
The frozen data of fiducial 3GPP protocol version : 2009/09.

System information handling:

System information is divided into the MasterInformationBlock (MIB) and a number of SystemInformationBlocks (SIBs). The MIB includes a limited number of most essential and most frequently transmitted parameters that are needed to acquire other information from the cell, and is transmitted on BCH. SIBs other than SystemInformationBlockType1 are carried in SystemInformation (SI) messages and mapping of SIBs to SI messages is flexibly configurable by schedulingInfoList included in SystemInformationBlockType1, with restrictions that: each SIB is contained only in a single SI message, only SIBs having the same scheduling requirement (periodicity) can be mapped to the same SI message, and SystemInformationBlockType2 is always mapped to the SI message that corresponds to the first entry in the list of SI messages in schedulingInfoList. There may be multiple SI messages transmitted with the same periodicity. SystemInformationBlockType1 and all SI messages are transmitted on DL-SCH.

Reference:
36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification;

小区选择流程



Special comments:

The frozen data of fiducial 3GPP protocol version : 2009/09.

1) Initial Cell Selection:

This procedure requires no prior knowledge of which RF channels are E-UTRA carriers. The UE shall scan all RF channels in the E-UTRA bands according to its capabilities to find a suitable cell. On each carrier frequency, the UE need only search for the strongest cell. Once a suitable cell is found this cell shall be selected.

2) Stored Information Cell Selection:

This procedure requires stored information of carrier frequencies and optionally also information on cell parameters, from previously received measurement control information elements or from previously detected cells. Once the UE has found a suitable cell the UE shall select it. If no suitable cell is found the Initial Cell Selection procedure shall be started.

suitable cell:

A "suitable cell" is a cell on which the UE may camp on to obtain normal service. Such a cell shall fulfil all the following requirements.

- The cell is part of either:
- the selected PLMN, or:
- the registered PLMN, or:
- a PLMN of the Equivalent PLMN list

according to the latest information provided by NAS:

- The cell is not barred
- The cell is part of at least one TA that is not part of the list of "forbidden tracking areas for roaming" , which belongs to a PLMN that fulfils the first bullet above;
- The cell selection criteria are fulfilled;
- For a CSG cell, the CSG ID is part of the allowed CSG list of the UE.

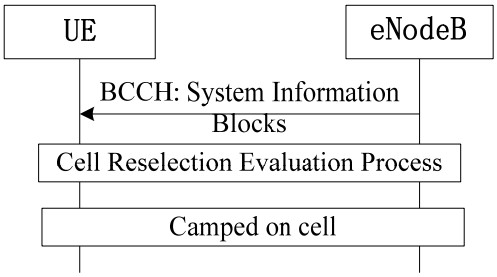
If more than one PLMN identity is broadcast in the cell, the cell is considered to be part of all TAs with TAIs constructed from the PLMN identities and the TAC broadcast in the cell.

Reference:

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification;

36.304: Evolved Universal Terrestrial Radio Access (E-UTRA);Equipment (UE) procedures in idle mode

小区重选流程



Special comments:

The frozen data of fiducial 3GPP protocol version : 2009/09.

Reselection priorities handling:

1)Absolute priorities of different E-UTRAN frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the RRCConnectionRelease message, or by inheriting from another RAT at inter-RAT cell (re)selection.

2)In the case of system information, an E-UTRAN frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field cellReselectionPriority is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information.

3)If UE is in camped on any cell state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling unless specified otherwise.

4)When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than the eight network configured values).

5)The UE shall delete priorities provided by dedicated signalling when:

- the UE enters RRC_CONNECTED state; or
- the optional validity time of dedicated priorities (T320) expires; or
- a PLMN selection is performed on request by NAS.

6)The UE shall only perform cell reselection evaluation for E-UTRAN frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

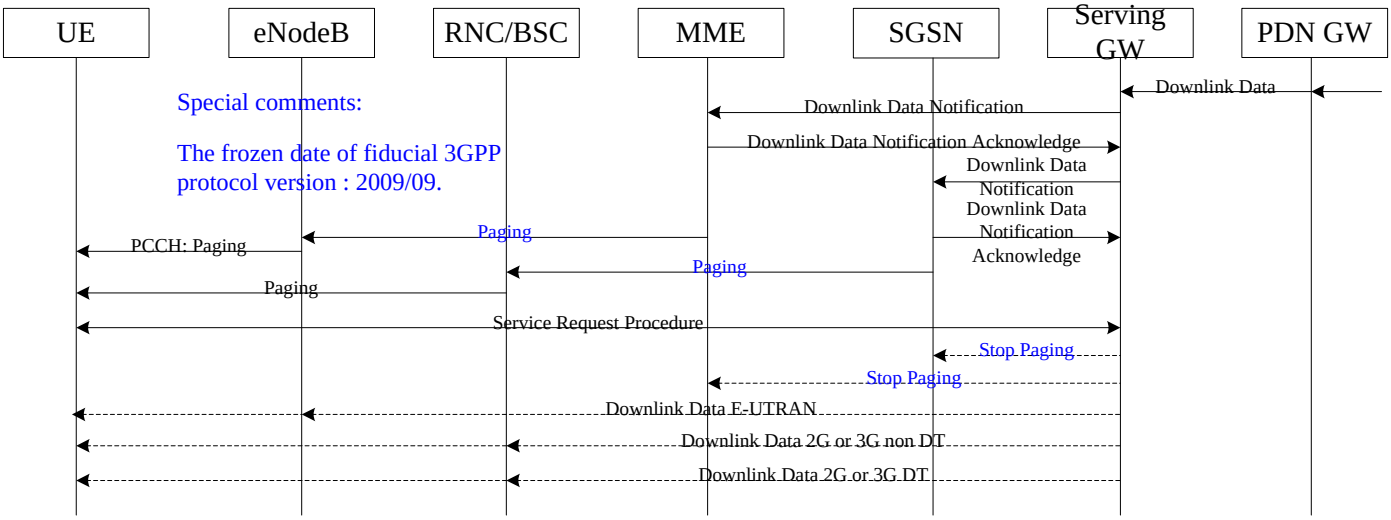
7)The UE shall not consider any black listed cells as candidate for cell reselection.

8)The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e., T320 in E-UTRA, T322 in UTRA and [T3230, FFS] in GERAN), if configured, at inter-RAT cell (re)selection.

Reference:

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification;
36.304: Evolved Universal Terrestrial Radio Access (E-UTRA);Equipment (UE) procedures in idle mode

寻呼过程流程



Network Trigged Service Request(Paging) procedure:

If the MME needs to signal with the UE that is in ECM-IDLE state, e.g. to perform the MME/HSS-initiated detach procedure for the ECM-IDLE mode UE or the S−GW receives control signalling (e.g. Create Dedicated Bearer Request or Modify Dedicated Bearer Request), the MME starts network triggered service request procedure from step 3.

If ISR is activated, when the Serving GW receives a Create Dedicated Bearer Request or Modify Bearer Request for a UE, and the S−GW does not have a downlink S1-U and the SGSN has notified the Serving GW that the UE has moved to PMM-IDLE or STANDBY state, the Serving GW buffers signalling messages and triggers MME and SGSN to page UE. In this case the S−GW will be notified about the current RAT type based on the UE triggered service request procedure. The S−GW will go on executing the dedicated bearer activation or dedicated bearer modification procedure, i.e. send the corresponding buffered signalling to MME or SGSN which UE resides in now and inform the current RAT type to the PDN GW if the RAT type has been changed compared to the last reported RAT Type. If dynamic PCC is deployed, the current RAT type information shall also be conveyed from the PDN GW to the PCRF. If the PCRF response leads to an EPS bearer modification the PDN GW should initiate a bearer update procedure as specified in clause 5.4.2.1 below.

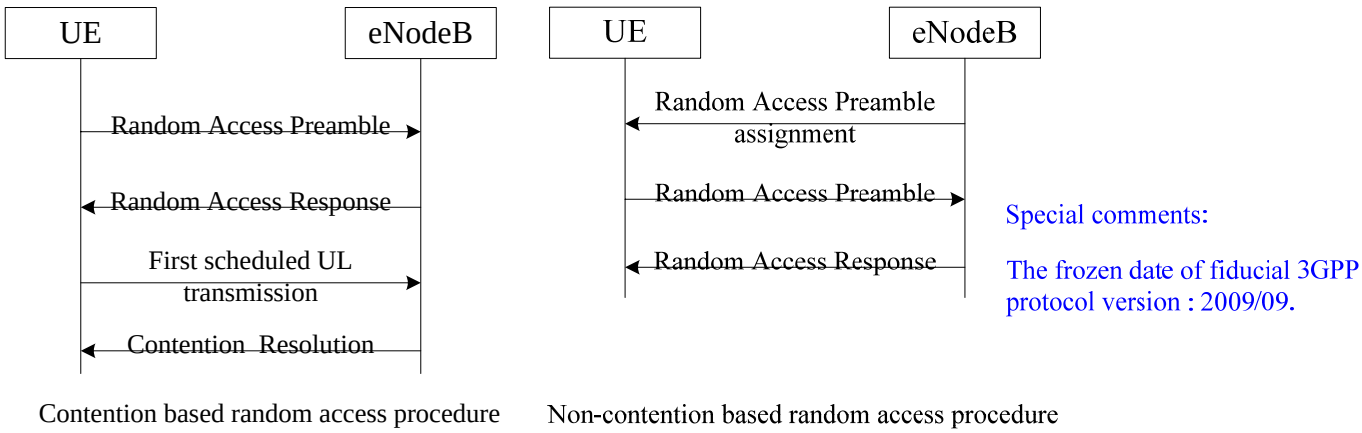
Reference:

23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification;

36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

随机接入流程



Contention based random access procedure

Non-contention based random access procedure

Random Access procedure:

The random access procedure is characterized by:

- Common procedure for FDD and TDD;
- One procedure irrespective of cell size;

The random access procedure is performed for the following five events:

- Initial access from RRC_IDLE;
- RRC Connection Re-establishment procedure;
- Handover;
- DL data arrival during RRC_CONNECTED requiring random access procedure;
- E.g. when UL synchronisation status is “non-synchronised”;
- UL data arrival during RRC_CONNECTED requiring random access procedure;
  - E.g. when UL synchronisation status is "non-synchronised" or there are no PUCCH resources for SR available.

Furthermore, the random access procedure takes two distinct forms:

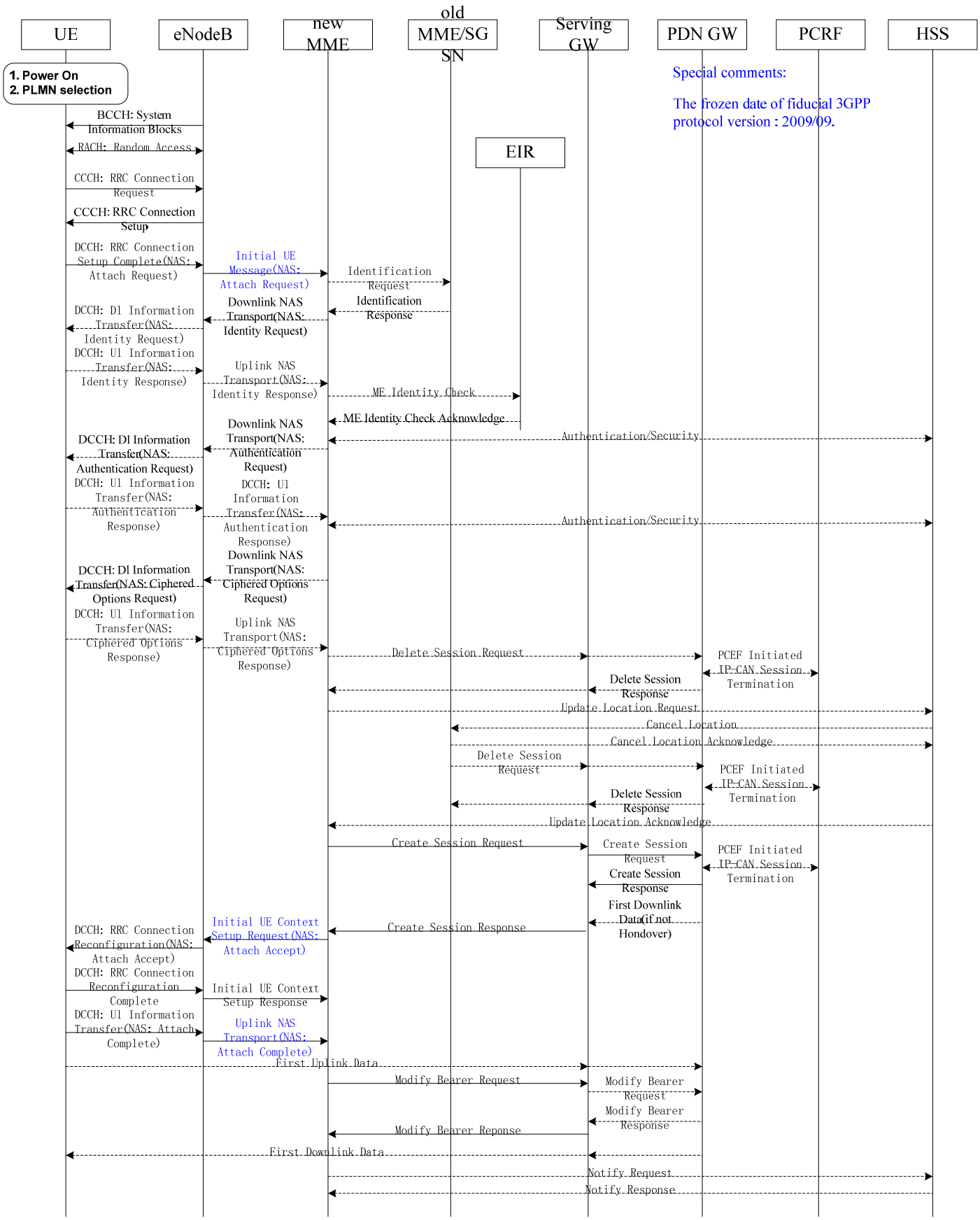
- Contention based (applicable to all five events);
- Non-contention based (applicable to only handover and DL data arrival).

Normal DL/UL transmission can take place after the random access procedure.

Reference:

36.300: Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2.

ATTACH流程


UE
eNodeB
new MME
old MME/SGSN
Serving GW
PDN GW
PCRF
HSS
EIR
1. Power On
2. PLMN selection
Special comments:
The frozen date of fiducial 3GPP protocol version : 2009/09.
BCCH: System Information Blocks
RACH: Random Access
CCCH: RRC Connection Request
CCCH: RRC Connection Setup
DCCH: RRC Connection Setup Complete(NAS: Attach Request)
Initial UE Message(NAS: Attach Request)
Identification Request
Identification Response
Downlink NAS Transport(NAS: Identity Request)
DCCH: Dl Information Transfer(NAS: Identity Request)
DCCH: Ul Information Transfer(NAS: Identity Response)
Uplink NAS Transport(NAS: Identity Response)
ME Identity Check
ME Identity Check Acknowledge
Downlink NAS Transport(NAS: Authentication Request)
DCCH: Dl Information Transfer(NAS: Authentication Request)
Authentication/Security
DCCH: Ul Information Transfer(NAS: Authentication Response)
Uplink NAS Transport(NAS: Authentication Response)
Authentication/Security
Downlink NAS Transport(NAS: Ciphered Options Request)
DCCH: Dl Information Transfer(NAS: Ciphered Options Request)
DCCH: Ul Information Transfer(NAS: Ciphered Options Response)
Uplink NAS Transport(NAS: Ciphered Options Response)
Delete Session Request
PCEF Initiated IP-CAN Session Termination
Delete Session Response
Update Location Request
Cancel Location
Cancel Location Acknowledge
Delete Session Request
PCEF Initiated IP-CAN Session Termination
Delete Session Response
Update Location Acknowledge
Create Session Request
Create Session Request
PCEF Initiated IP-CAN Session Termination
Create Session Response
First Downlink Data(if not Hondover)
Create Session Response
Initial UE Context Setup Request(NAS: Attach Accept)
DCCH: RRC Connection Reconfiguration(NAS: Attach Accept)
DCCH: RRC Connection Reconfiguration Complete
Initial UE Context Setup Response
DCCH: Ul Information Transfer(NAS: Attach Complete)
Uplink NAS Transport(NAS: Attach Complete)
First Uplink Data
Modify Bearer Request
Modify Bearer Request
Modify Bearer Response
Modify Bearer Reponse
First Downlink Data
Notify Request
Notify Response

E-UTRAN Initial Attach procedure:

A UE/user needs to register with the network to receive services that require registration. This registration is described as Network Attachment. The always-on IP connectivity for UE/users of the EPS is enabled by establishing a default EPS bearer during Network Attachment. The PCC rules applied to the default EPS bearer may be predefined in the PDN GW and activated in the attachment by the PDN GW itself. The Attach procedure may trigger one or multiple Dedicated Bearer Establishment procedures to establish dedicated EPS bearer(s) for that UE. During the attach procedure, the UE may request for an IP address allocation. Terminals utilising only IETF based mechanisms for IP address allocation are also supported.

During the Initial Attach procedure the Mobile Equipment Identity is obtained from the UE. The MME operator may check the ME Identity with an EIR. At least in roaming situations, the MME should pass the ME Identity to the HSS, and, if a PDN GW outside of the VPLMN, should pass the ME Identity to the PDN GW.

The E-UTRAN Initial Attach procedure is used for Emergency Attach by UEs that need to perform emergency services but cannot gain normal services from the network. These UEs are in limited service state as defined in TS 23.122 [10]. Also UEs that had attached for normal services and do not have emergency bearers established and are camped on a cell in limited service state (e.g. restricted Tracking Area or not allowed CSG) shall initiate the Attach procedures indicating that the attach is to receive emergency services. UEs that camp normally on a cell, i.e. UEs that are not in limited service state, should initiate normal initial attach when not already attached and shall initiate the UE Requested PDN Connectivity procedure to receive emergency EPS bearer services.

› NOTE 1: A UE that is emergency attached performs initial attach procedure before being able to obtain normal services.

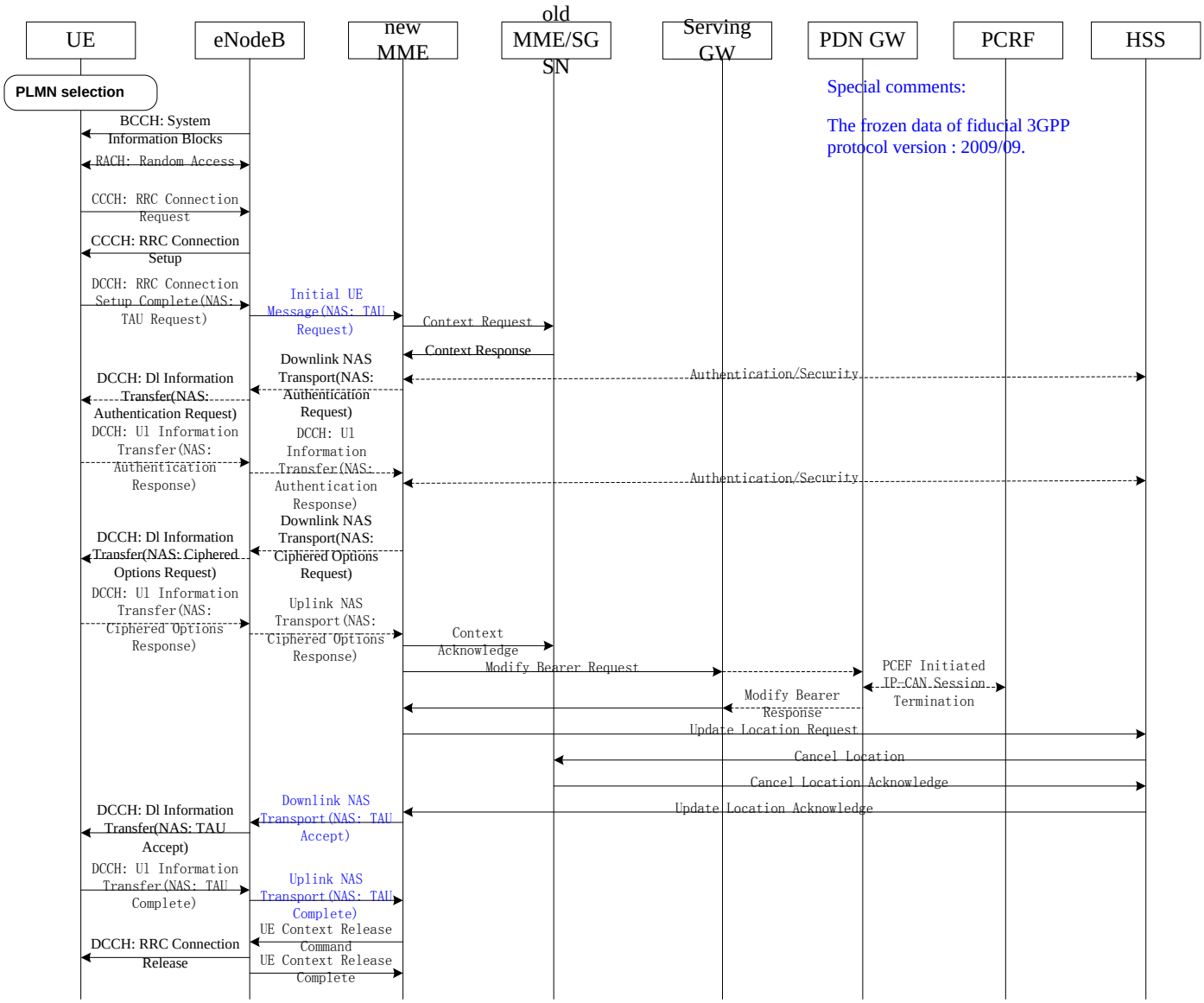
Reference:

23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification;

36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

TAU流程



E-UTRAN Tracking Area Update procedures:

The procedure is initiated by an UE in either ECM-IDLE state or ECM-CONNECTED state.

NOTE 1: If the tracking area update procedure fails a maximum allowable number of times, or if the MME returns a Tracking Area Update Reject (Cause) message, the UE shall enter EMM DEREGISTERED state.

If the Update Location Ack message indicates a reject, this should be indicated to the UE, and the UE shall not access non-PS services until a successful location update is performed.

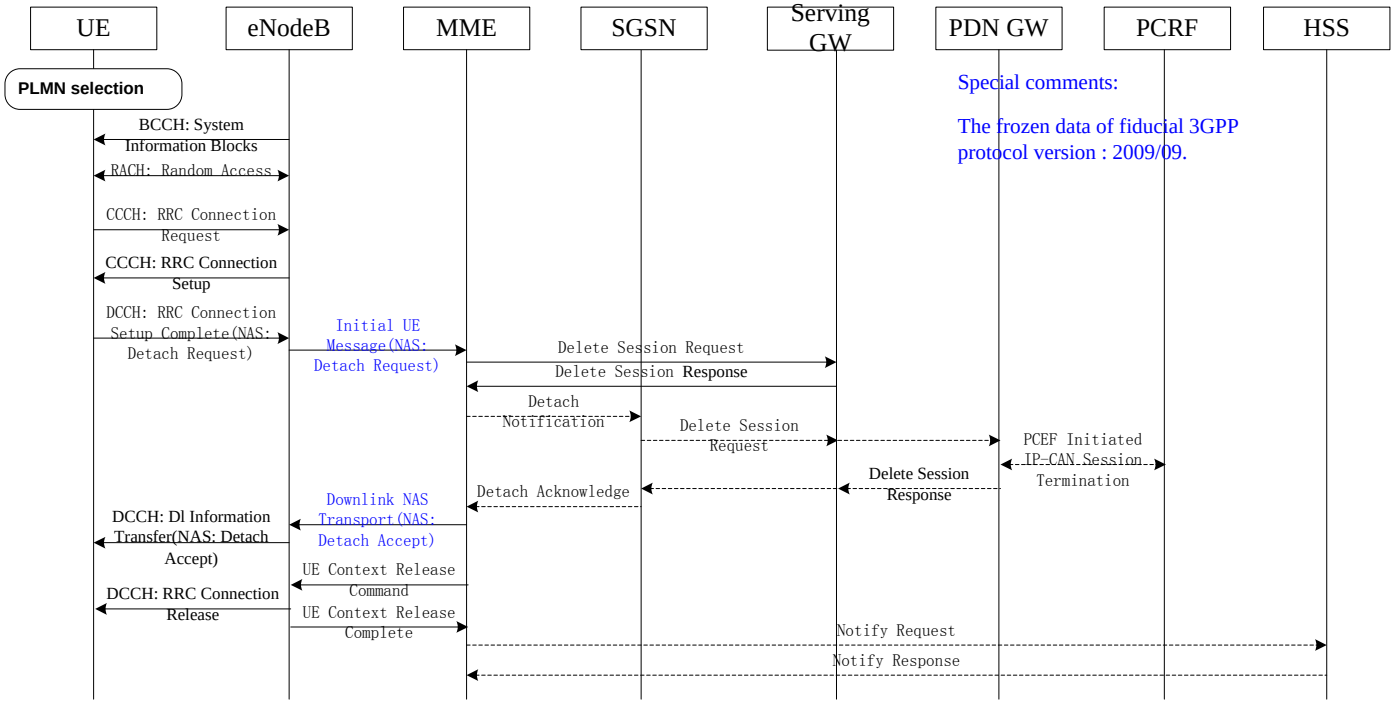
Reference:

23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification;

36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

DETACH流程



UE-initiated Detach procedure for E-UTRAN:

The Detach procedure is that UE camps on E-UTRAN and Detach Request is sent to MME.

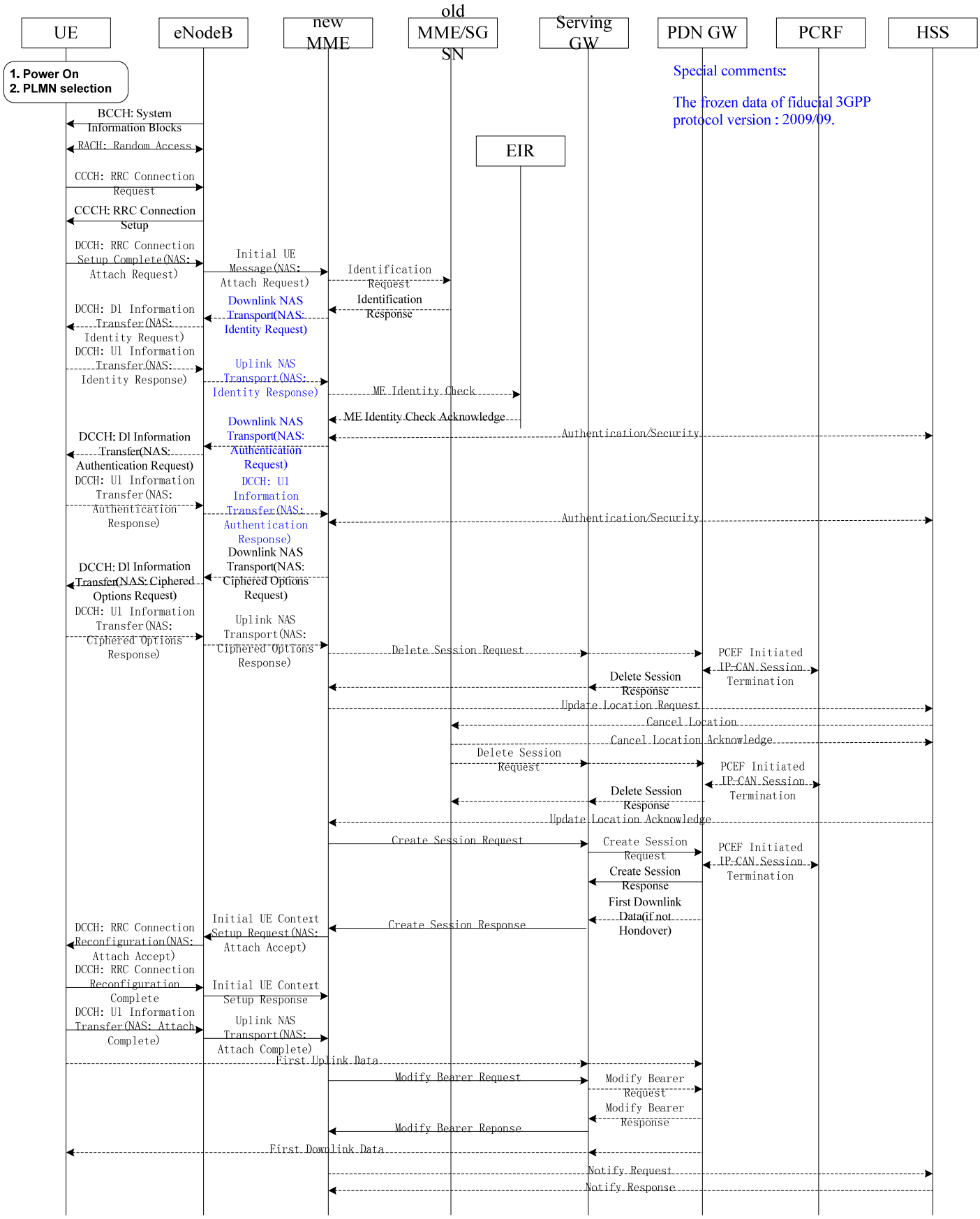
Reference:

23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification;

36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

鉴权流程


UE
eNodeB
new MME
old MME/SGSN
Serving GW
PDN GW
PCRF
HSS
EIR
1. Power On
2. PLMN selection
Special comments:
The frozen data of fiducial 3GPP protocol version : 2009/09.
BCCH: System Information Blocks
RACH: Random Access
CCCH: RRC Connection Request
CCCH: RRC Connection Setup
DCCH: RRC Connection Setup Complete(NAS: Attach Request)
Initial UE Message(NAS: Attach Request)
Identification Request
Identification Response
Downlink NAS Transport(NAS: Identity Request)
DCCH: Dl Information Transfer(NAS: Identity Request)
DCCH: Ul Information Transfer(NAS: Identity Response)
Uplink NAS Transport(NAS: Identity Response)
ME Identity Check
ME Identity Check Acknowledge
Authentication/Security
Downlink NAS Transport(NAS: Authentication Request)
DCCH: Dl Information Transfer(NAS: Authentication Request)
DCCH: Ul Information Transfer(NAS: Authentication Response)
Uplink NAS Transport(NAS: Authentication Response)
Authentication/Security
Downlink NAS Transport(NAS: Ciphered Options Request)
DCCH: Dl Information Transfer(NAS: Ciphered Options Request)
DCCH: Ul Information Transfer(NAS: Ciphered Options Response)
Uplink NAS Transport(NAS: Ciphered Options Response)
Delete Session Request
PCEF Initiated IP-CAN Session Termination
Delete Session Response
Update Location Request
Cancel Location
Cancel Location Acknowledge
Delete Session Request
PCEF Initiated IP-CAN Session Termination
Delete Session Response
Update Location Acknowledge
Create Session Request
Create Session Request
PCEF Initiated IP-CAN Session Termination
Create Session Response
First Downlink Data(if not Hondover)
Initial UE Context Setup Request(NAS: Attach Accept)
Create Session Response
DCCH: RRC Connection Reconfiguration(NAS: Attach Accept)
DCCH: RRC Connection Reconfiguration Complete
Initial UE Context Setup Response
DCCH: Ul Information Transfer(NAS: Attach Complete)
Uplink NAS Transport(NAS: Attach Complete)
First Uplink Data
Modify Bearer Request
Modify Bearer Request
Modify Bearer Response
Modify Bearer Reponse
First Downlink Data
Notify Request
Notify Response

鉴权流程

E-UTRAN Authentication and Key Agreement procedure:

EPS AKA is the authentication and key agreement procedure that shall be used over E-UTRAN, between the UE and MME. EPS AKA is specified in TS 33.401 [41].

EPS AKA shall produce keying material forming a basis for user plane (UP), RRC, and NAS ciphering keys as well as RRC and NAS integrity protection keys.

Reference:

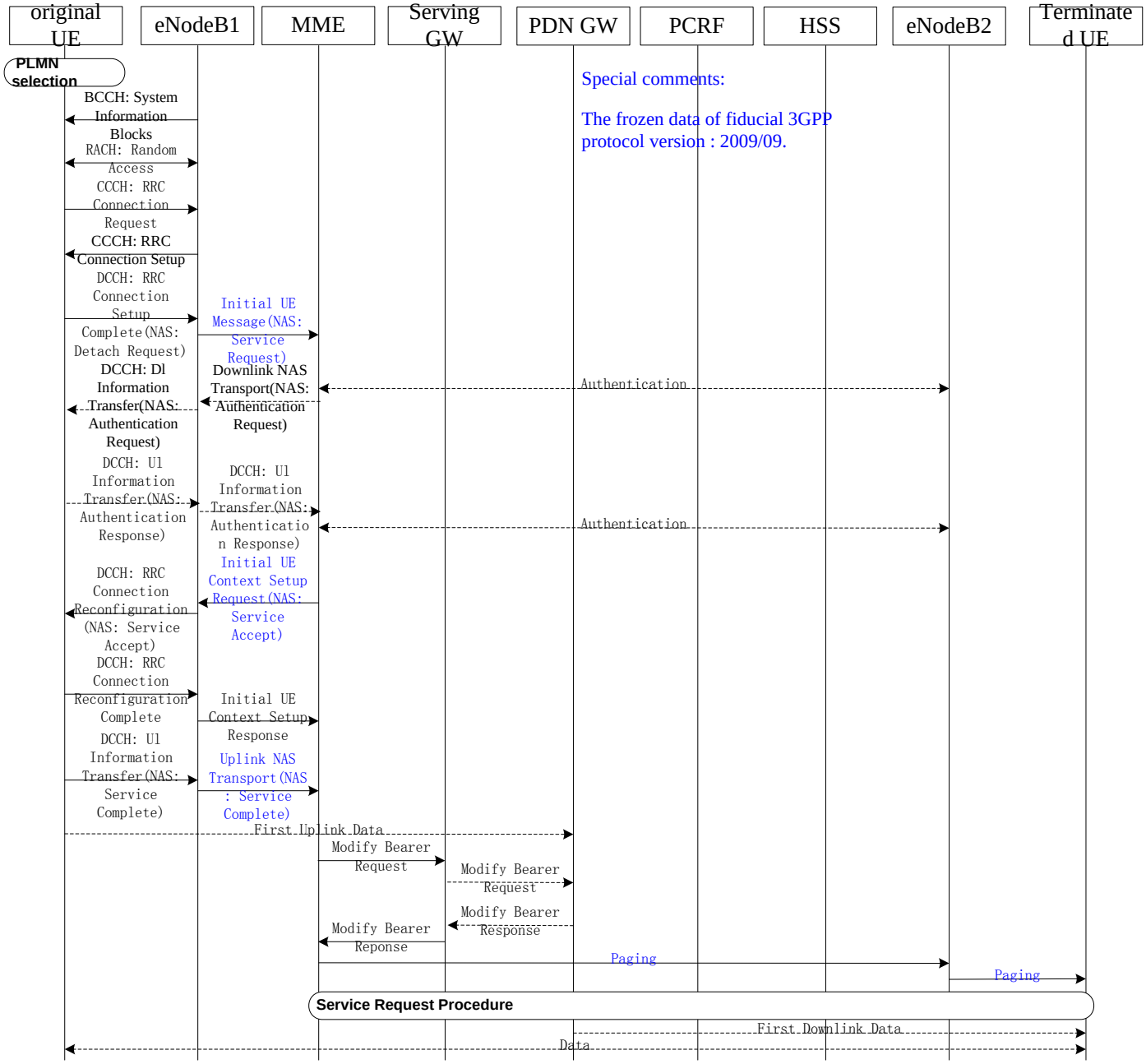
23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

33.401: 3GPP System Architecture Evolution (SAE); Security architecture.

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification;

36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

UE呼叫流程



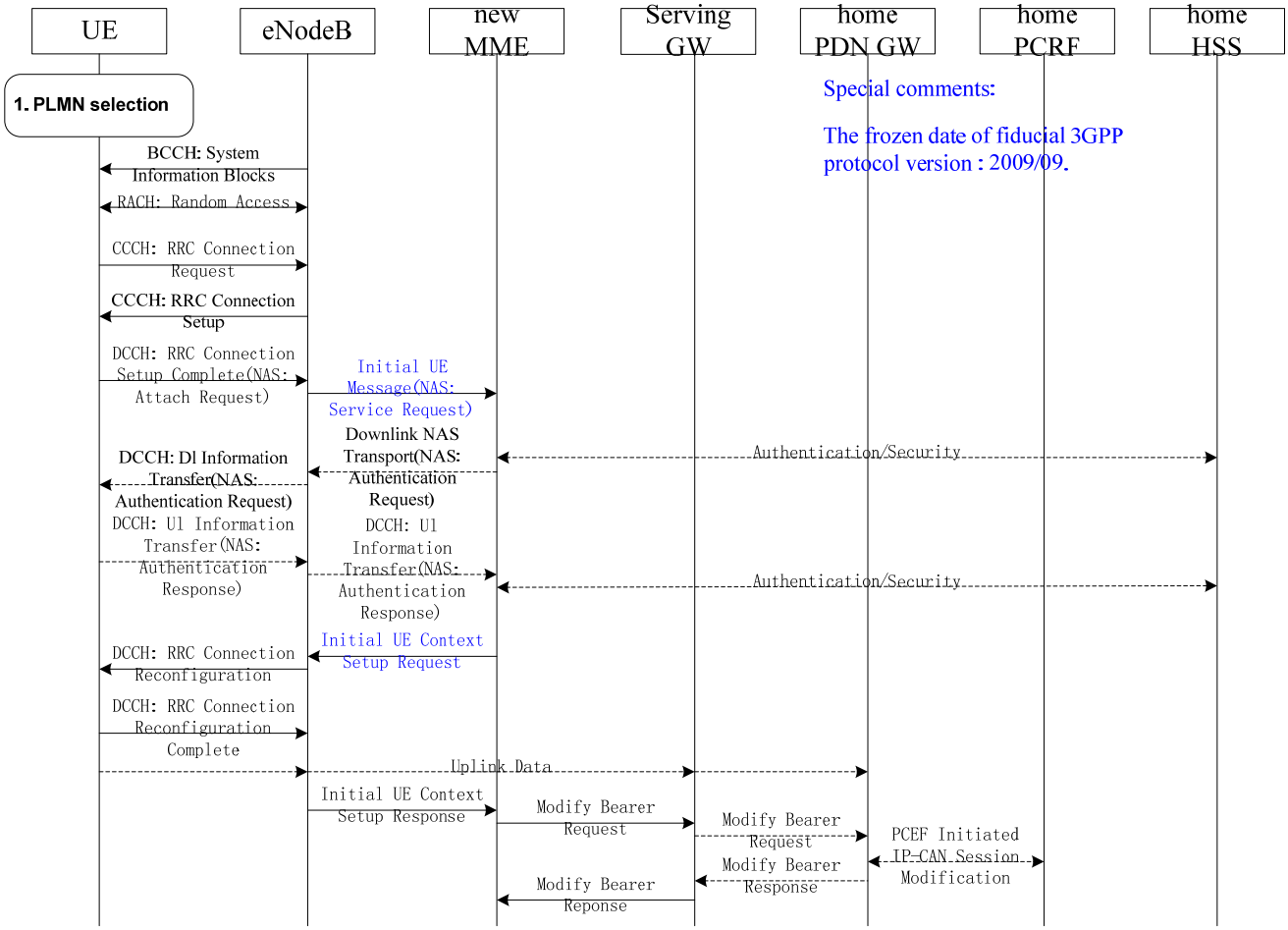
Reference:

23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification;

36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

漫游用户服务过程



E-UTRAN Roaming procedure:

In the roaming scenario the vPLMN operates Gn/Gp 2G and/or 3G SGSNs as well as MME and S−GW for E-UTRAN access. The hPLMN operates a P−GW.

Roaming and inter access mobility between Gn/Gp 2G and/or 3G SGSNs and an MME/S−GW are enabled by:

- Gn functionality as specified between two Gn/Gp SGSNs, which is provided by the MME, and
- Gp functionality as specified between Gn/Gp SGSN and Gn/Gp GGSN that is provided by the P−GW.

All this Gp and Gn functionality bases on GTP version 1 only.

For roaming subscribers the MME may alternatively choose the RFSP Index in use based on the visited network policy (e.g., an RFSP Index value pre-configured per HPLMN, or a single RFSP Index value to be used for all roamers independent of the HPLMN).

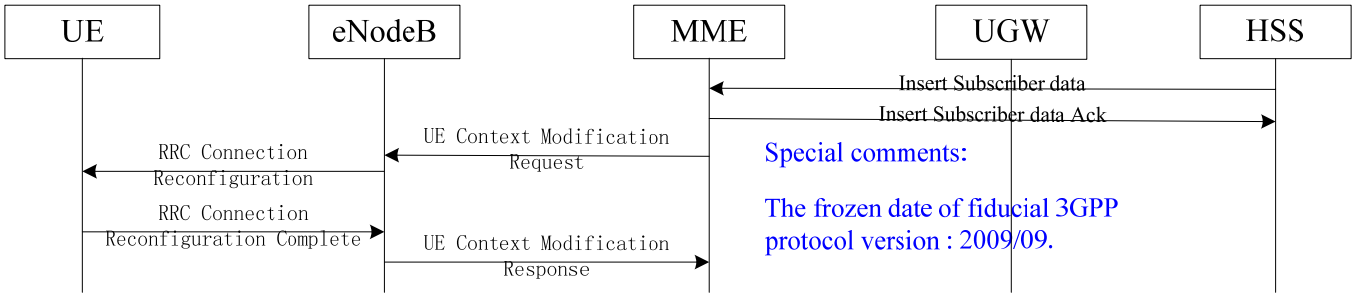
Reference:

23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification;

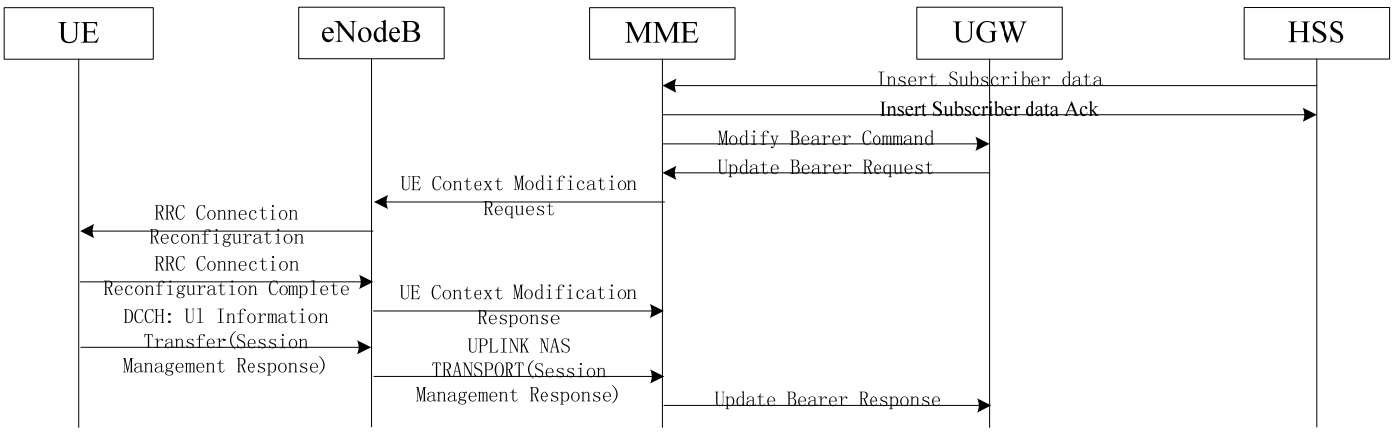
36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

UE上下文修改流程



HSS to update the HSS user profile stored in the MME. Whenever the HSS user profile is changed for a user in the HSS, and the changes affect the HSS user profile stored in the MME, the MME shall be informed.

The MME builds a Session Management Request including the PTI, EPS Bearer QoS parameters (excluding ARP), TFT, APN-AMBR and EPS Bearer Identity.



HSS to update the HSS user profile stored in the MME. Whenever the HSS user profile is changed for a user in the HSS, and the changes affect the HSS user profile stored in the MME, the MME shall be informed.

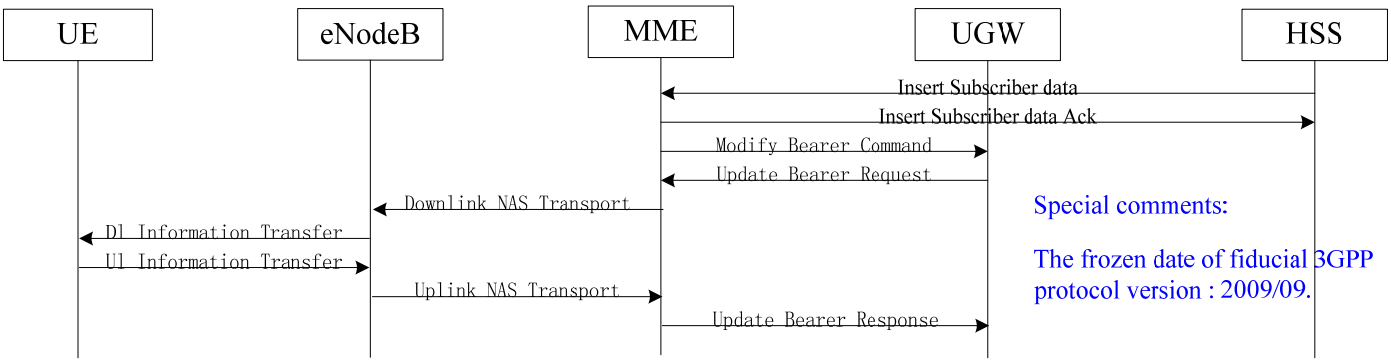
If the QCI and/or ARP and/or subscribed APN-AMBR has been modified and there is related active PDN connection with the modified QoS Profile the MME sends the Modify Bearer Command (EPS Bearer Identity, EPS Bearer QoS, APN-AMBR) message to the Serving GW. The EPS Bearer Identity identifies the default bearer of the affected PDN connection. The EPS Bearer QoS contains the EPS subscribed QoS profile to be updated.

The Serving GW sends the Modify Bearer Command (EPS Bearer Identity, EPS Bearer QoS, APN-AMBR) message to the PDN GW

If the QCI and/or ARP parameter(s) have been modified,The Serving GW sends the Update Bearer Request (PTI, EPS Bearer Identity, EPS Bearer QoS, TFT, APN-AMBR) message to the MME

The MME builds a Session Management Request including the PTI, EPS Bearer QoS parameters (excluding ARP), TFT, APN-AMBR and EPS Bearer Identity.

UE上下文修改流程（续）



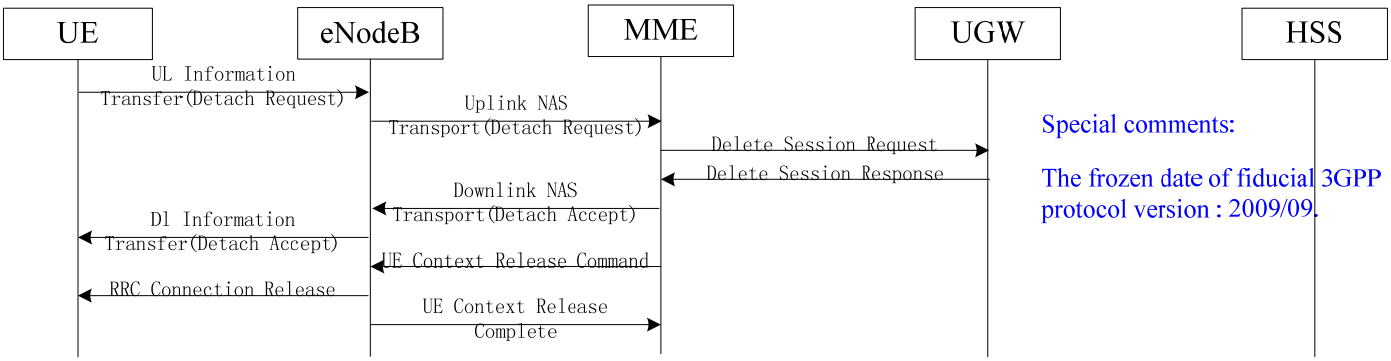
HSS to update the HSS user profile stored in the MME. Whenever the HSS user profile is changed for a user in the HSS, and the changes affect the HSS user profile stored in the MME, the MME shall be informed.

If neither the QCI nor the ARP have been modified, but instead only the APN-AMBR was updated ,The MME builds a Session Management Request message including the TFT, APN-AMBR and EPS Bearer Identity. The MME then sends a Downlink NAS Transport (Session Management Configuration) message to the eNodeB. If the APN AMBR has changed, the MME may also update the UE AMBR.

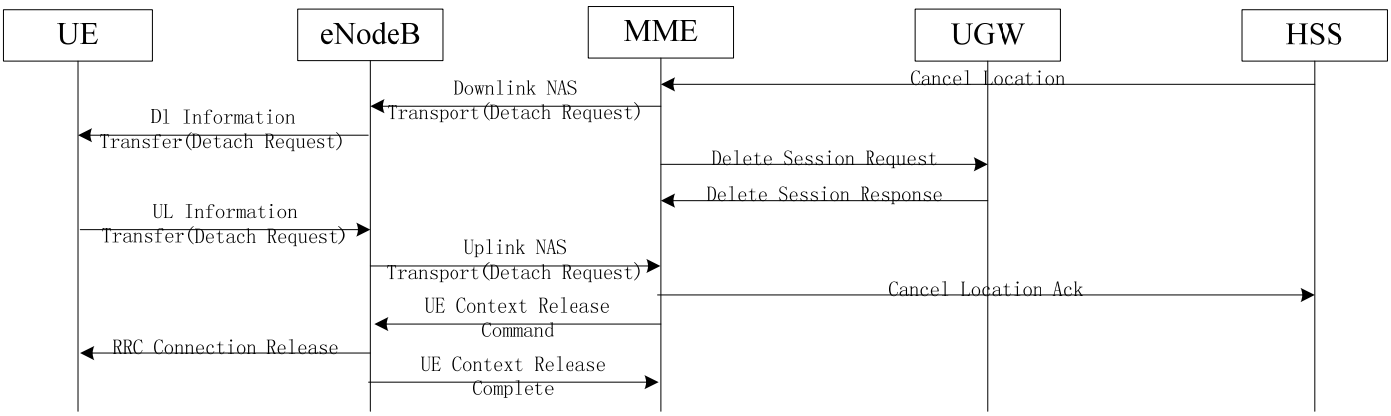
The eNodeB sends the Direct Transfer (Session Management Request) message to the UE. The UE uses the uplink packet filter (UL TFT) to determine the mapping of traffic flows to the radio bearer. The UE stores the modified APN-AMBR value. The UE shall set its TIN to "GUTI" if the modified EPS bearer was established before ISR activation.

The UE NAS layer builds a Session Management Response including EPS Bearer Identity. The UE then sends a Direct Transfer (Session Management Response) message to the eNodeB.

UE上下文释放流程



The UE sends NAS message Detach Request (GUTI, Switch Off) to the MME. This NAS message is used to trigger the establishment of the S1 connection if the UE was in ECM-IDLE mode. Switch Off indicates whether detach is due to a switch off situation or not. The eNodeB forwards this NAS message to the MME along with the TAI+ECGI of the cell which the UE is using.



The HSS-Initiated Detach procedure is initiated by the HSS. The HSS uses this procedure for operator-determined purposes to request the removal of a subscriber's MM and EPS bearer at the MME and also at the SGSN if both an MME and an SGSN are registered in the HSS.

If the HSS wants to request the immediate deletion of a subscriber's MM contexts and EPS Bearers, the HSS shall send a Cancel Location (IMSI, Cancellation Type) message with Cancellation Type set to Subscription Withdrawn to the registered MME and also to the SGSN if an SGSN is also registered.

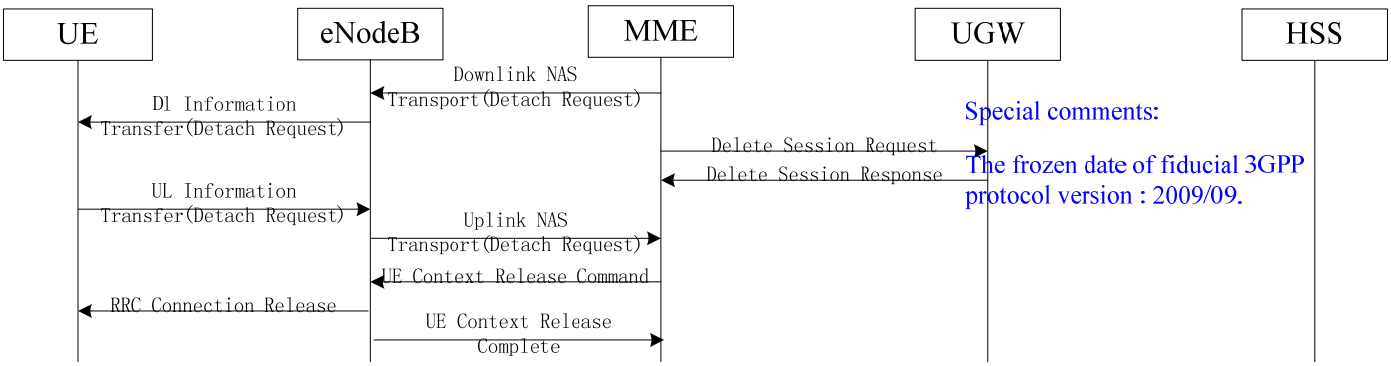
The UE will receive only one Detach Request message in the RAT where it currently camps on

If the MME has an active UE context, the MME sends a Delete Session Request (TEID) message to the Serving GW to deactivate the EPS Bearer Context information in the Serving GW.

When the S−GW receives the first Delete Session Request message from the MME or SGSN in ISR activated state, the Serving GW deactivates ISR, releases the related EPS Bearer context information and responds with Delete Session Response

After receiving the Detach Accept message, the MME releases the S1-MME signalling connection for the UE by sending S1 Release Command (Cause) message to the eNodeB with Cause set to Detach. The details of this step are covered in the "S1 Release Procedure",

UE上下文释放流程（续）



The MME initiated detach procedure is either explicit (e.g. by O&M intervention) or implicit. The MME may implicitly detach a UE, if it has not had communication with UE for a long period of time. The MME does not send the Detach Request (Detach Type) message to the UE for implicit detach. The implicit detach is local to the MME, i.e. an SGSN registration will not be detached. If the UE is in ECM-CONNNECTED state the MME may explicitly detach the UE by sending a Detach Request message to the UE. The Detach Type may be set to re-attach in which case the UE should re-attach at the end of the detach process. If the UE is in ECM-IDLE state the MME pages the UE.

Any EPS Bearer Context information in the Serving GW regarding this particular UE and related to the MME are deactivated by the MME sending Delete Session Request (TEID) message to the Serving GW. If the PDN GW requested UE's location info, the MME also includes the User Location Information IE in this message.

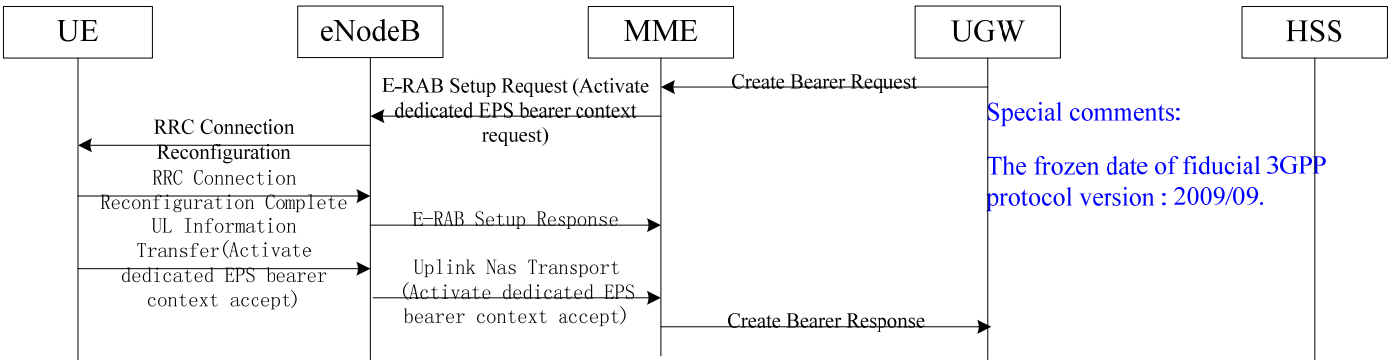
When the S−GW receives the first Delete Session Request message from the MME or SGSN in ISR activated state, the Serving GW deactivates ISR, releases the related EPS Bearer context information and responds with Delete Session Response (TEID).

When the S−GW receives the Delete Session Request message from the MME or SGSN in ISR deactivated state, the Serving GW releases the related EPS Bearer context information and jumps to step 6 by sending a Delete Session Request (TEID) message to the PDN GW. After step 7 the Serving GW responds back to the MME/SGSN with the Delete Session Response (TEID) message.

If the UE receives the Detach Request message from the MME in the step 1, the UE sends a Detach Accept message to the MME any time after step 1. The eNodeB forwards this NAS message to the MME along with the TAI+ECGI of the cell which the UE is using.

After receiving the Detach Accept message, Delete Session Response and, if appropriate, Detach Acknowledge message, the MME releases the S1-MME signalling connection for the UE by sending an S1 Release Command (Cause) message to the eNodeB. The details of this step are covered in the "S1 Release Procedure", as described in clause 5.3.5 by step 4 to step 6. If the Detach Type requests the UE to make a new attach, the UE reattaches after the RRC Connection Release is completed.

E-RAB建立流程



If dynamic PCC is deployed, the PCRF sends a PCC decision provision (QoS policy) message to the PDN GW. This corresponds to the initial steps of the PCRF-Initiated IP−CAN Session Modification procedure or to the PCRF response in the PCEF initiated IP-CAN Session Modification procedure as defined in TS 23.203 [6], up to the point that the PDN GW requests IP−CAN Bearer Signalling. If dynamic PCC is not deployed, the PDN GW may apply local QoS policy.

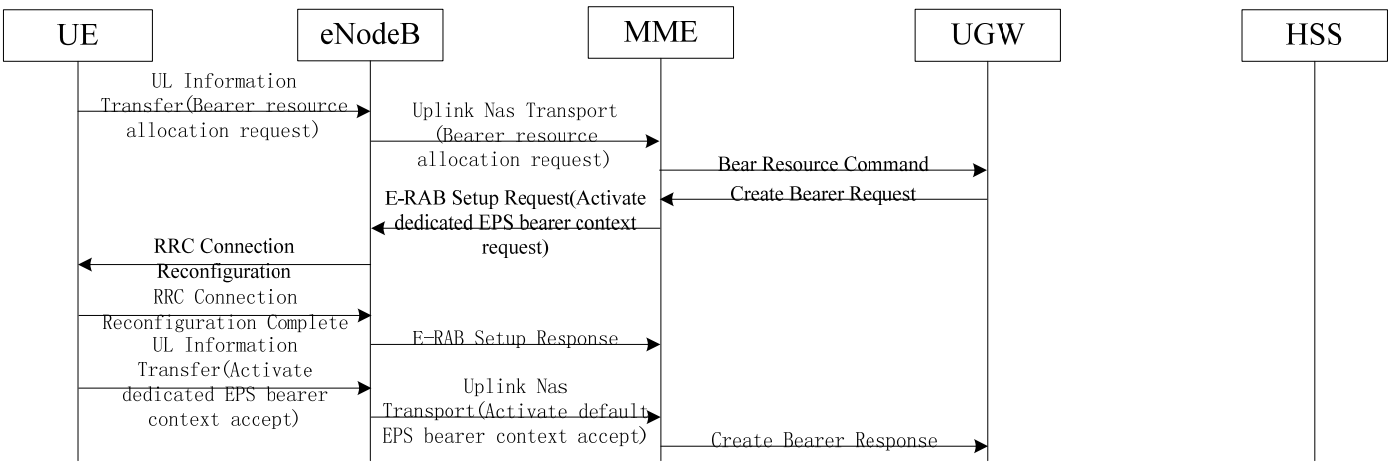
The Serving GW sends the Create Bearer Request (IMSI, PTI, EPS Bearer QoS, TFT, S1-TEID, LBI, Protocol Configuration Options) message to the MME.

The MME selects an EPS Bearer Identity, which has not yet been assigned to the UE. The MME then builds a Session Management Request including the PTI, TFT, EPS Bearer QoS parameters (excluding ARP), Protocol Configuration Options, the EPS Bearer Identity and the Linked EPS Bearer Identity (LBI). If the UE has UTRAN or GERAN capabilities, the MME uses the EPS bearer QoS parameters to derive the corresponding PDP context parameters QoS Negotiated (R99 QoS profile), Radio Priority, Packet Flow Id and TI and includes them in the Session Management Request. If the UE indicated in the UE Network Capability it does not support BSS packet flow procedures, then the MME shall not include the Packet Flow Id. The MME then signals the Bearer Setup Request (EPS Bearer Identity, EPS Bearer QoS, Session Management Request, S1-TEID) message to the eNodeB.

The eNodeB maps the EPS Bearer QoS to the Radio Bearer QoS. It then signals a RRC Connection Reconfiguration (Radio Bearer QoS, Session Management Request, EPS RB Identity) message to the UE. The UE shall store the QoS Negotiated, Radio Priority, Packet Flow Id and TI, which it received in the Session Management Request, for use when accessing via GERAN or UTRAN. The UE NAS stores the EPS Bearer Identity and links the dedicated bearer to the default bearer indicated by the Linked EPS Bearer Identity (LBI). The UE uses the uplink packet filter (UL TFT) to determine the mapping of traffic flows to the radio bearer. The UE may provide the EPS Bearer QoS parameters to the application handling the traffic flow. The application usage of the EPS Bearer QoS is implementation dependent. The UE shall not reject the RRC Connection Reconfiguration on the basis of the EPS Bearer QoS parameters contained in the Session Management Request.

The UE NAS layer builds a Session Management Response including EPS Bearer Identity. The UE then sends a Direct Transfer (Session Management Response) message to the eNodeB.

E-RAB建立流程



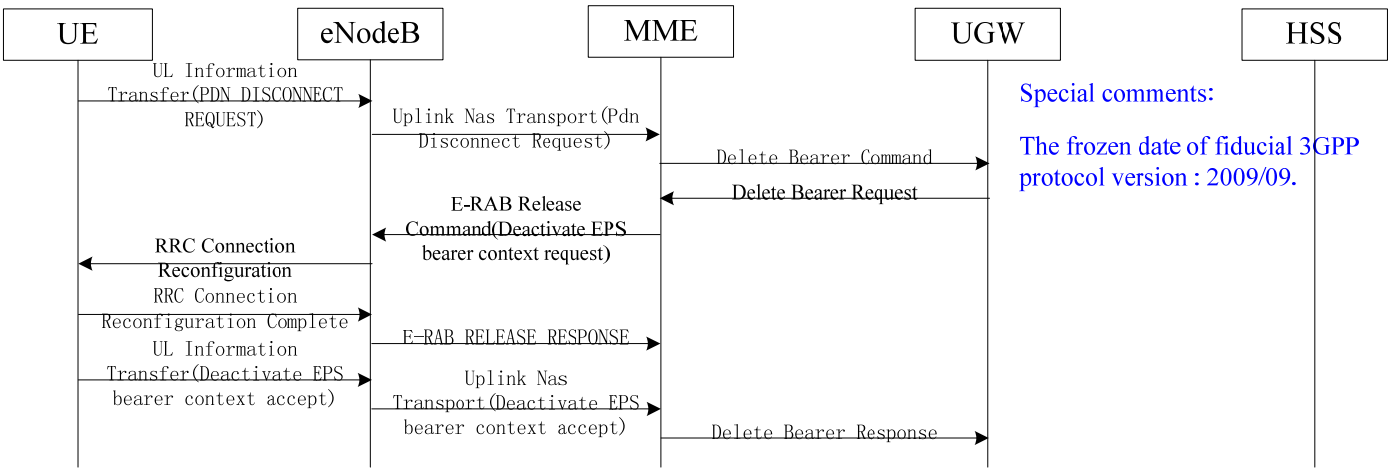
The purpose of the UE requested bearer resource allocation procedure is for a UE to request an allocation of bearer resources for a traffic flow aggregate. The UE requests a specific QoS demand (QCI) and optionally sends a GBR requirement for a new traffic flow aggregate. If accepted by the network, this procedure invokes a dedicated EPS bearer context activation procedure (see subclause 6.4.2) or an EPS bearer context modification procedure (see subclause 6.4.3).

In order to request the allocation of bearer resources for one traffic flow aggregate, the UE shall send a BEARER RESOURCE ALLOCATION REQUEST message to the MME, start timer T3480 and enter the state PROCEDURE TRANSACTION PENDING

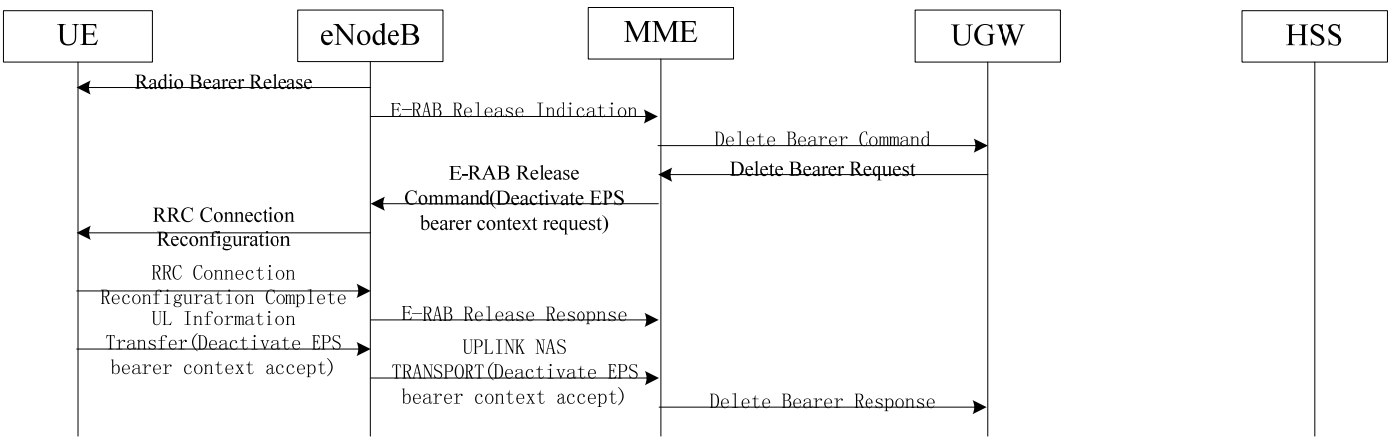
Upon receipt of the BEARER RESOURCE ALLOCATION REQUEST message, the MME checks whether the resources requested by the UE can be established by verifying the EPS bearer identity given in the Linked EPS bearer identity IE to be any of the active default EPS bearer context(s).

If the bearer resource allocation requested is accepted by the network, the MME shall initiate either a dedicated EPS bearer context activation procedure or an EPS bearer context modification procedure.

E-RAB释放流程



The purpose of the UE requested PDN disconnection procedure is for a UE to request disconnection from one PDN. The UE can initiate this procedure to disconnect from any PDN as long as it is connected to at least one other PDN. With this procedure, all EPS bearer contexts established towards this PDN, including the default EPS bearer context, are released.



Radio bearers for the UE in the ECM-CONNECTED state may be released due to local reasons (e.g. abnormal resource limitation or radio conditions do not allow the eNodeB to maintain all the allocated GBR bearers: it is not expected that non-GBR bearers are released by the eNodeB unless caused by error situations). The UE deletes the bearer contexts related to the released radio bearers.

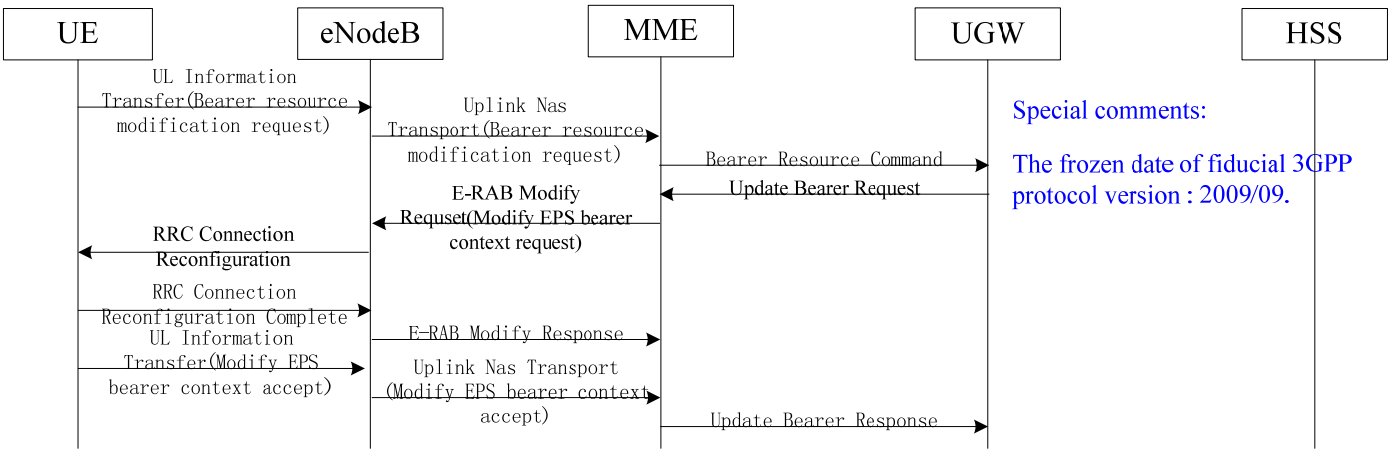
When the eNodeB releases radio bearers in step 0, it sends an indication of bearer release to the MME. This indication may be e.g. the Bearer Release Request (EPS Bearer Identity) message to the MME, or alternatively Initial Context Setup Complete, Handover Request Ack and UE Context Response, Path Switch Request may also indicate the release of a bearer.

The MME sends the Delete Bearer Command (EPS Bearer Identity) message to the Serving GW to deactivate the selected dedicated bearer.

The Serving GW sends the Delete Bearer Request (EPS Bearer Identity) message to the MME.

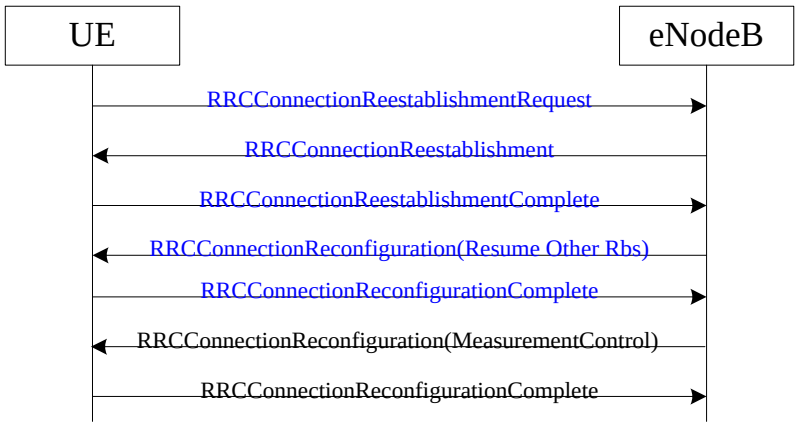
The MME deletes the bearer contexts related to the deactivated EPS bearer and acknowledges the bearer deactivation to the Serving GW by sending a Delete Bearer Response (EPS Bearer Identity) message.

E-RAB修改流程



The UE requested bearer resource modification procedure for an E-UTRAN allows the UE to request for a modification of bearer resources (e.g. allocation or release of resources) for one traffic flow aggregate with a specific QoS demand. Alternatively, the procedure allows the UE to request for the modification of the packet filters used for an active traffic flow aggregate, without changing QoS. If accepted by the network, the request invokes either the Dedicated Bearer Activation Procedure, the Bearer Modification Procedure or a dedicated bearer is deactivated using the PDN GW Initiated Bearer Deactivation Procedure. The procedure is used by the UE when the UE already has a PDN connection with the PDN GW. A UE can send a subsequent Request Bearer Resource Modification Message before the previous procedure is completed.

RRC重建流程



Special comments:

The frozen date of fiducial 3GPP

protocol version : 2009/09.

RRC Connection Establishment procedure:

The purpose of this procedure is to re-establish the RRC connection, which involves the resumption of SRB1 operation and the re-activation of security.

A UE in RRC_CONNECTED, for which security has been activated, may initiate the procedure in order to continue the RRC connection. The connection re-establishment succeeds only if the concerned cell is prepared i.e. has a valid UE context. In case E-UTRAN accepts the re-establishment, SRB1 operation resumes while the operation of other radio bearers remains suspended. If AS security has not been activated, the UE does not initiate the procedure but instead moves to RRC_IDLE directly.

E-UTRAN applies the procedure as follows:

› - to reconfigure SRB1 and to resume data transfer only for this RB;

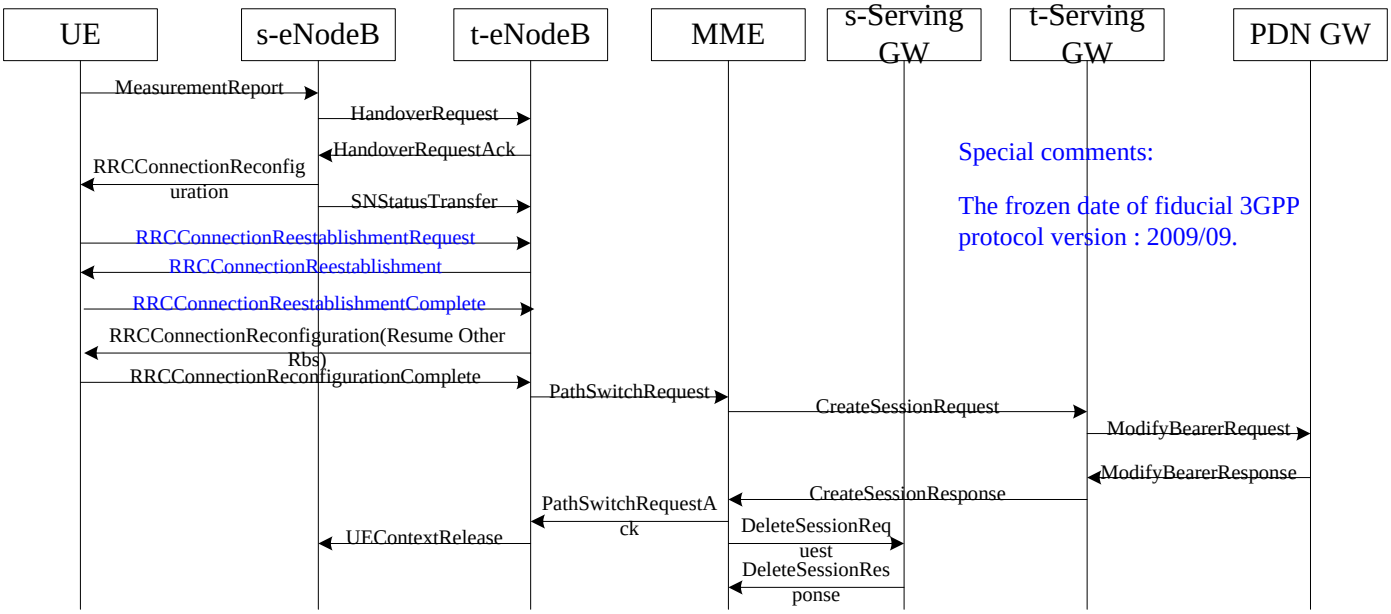
- to re-activate AS security without changing algorithms.

The first *RRCConnectionReconfiguration* message is used to resume SRB2 and all DRBs that are suspended after successful completion of the RRC Connection Re-establishment procedure.

Reference:

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification.

RRC重建到目标小区流程



X2HO－RRC Reestab(ReestablishmentCause:handoverFailure)

RRC Connection Re-establishment Cross Inter-eNB Handover procedure:

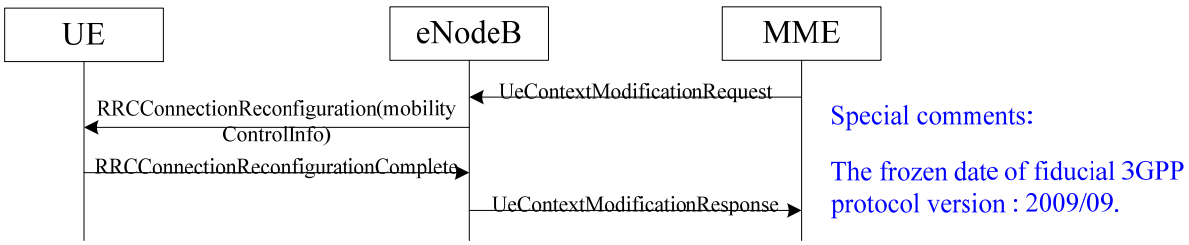
In case of Inter-eNB handover within E-UTRA, When there are the UE context in the target eNB. The UE maybe initiate the RRC connection re-establishment procedure due to handover failure, and the current cell is the handover target cell or other cells under control of the target eNB.

The Inter-eNB handover procedure continue execute after successful completion of the RRC Connection Re-establishment procedure.

Reference:

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification.

小区内切换流程



An intra cell handover initiated by the MME

Intra-Cell Handover procedure:

An intra-cell handover procedure may be used to change the keys in RRC_CONNECTED.The procedure is performed for the following case:

- If AS Keys (KUPenc , KRRCint and KRRCenc) need to be changed in RRC_CONNECTED, an intra-cell handover shall be used.

  - E.g.1: MME triggers an intra cell handover because KeNB refresh periodically.

  - E.g.2: For X2-handover procedure, The target eNB can immediately initiate an intra-cell handover to take the new NH into use once the new NH has arrived in the S1 PATH SWITCH REQUEST ACKNOWLEDGE.

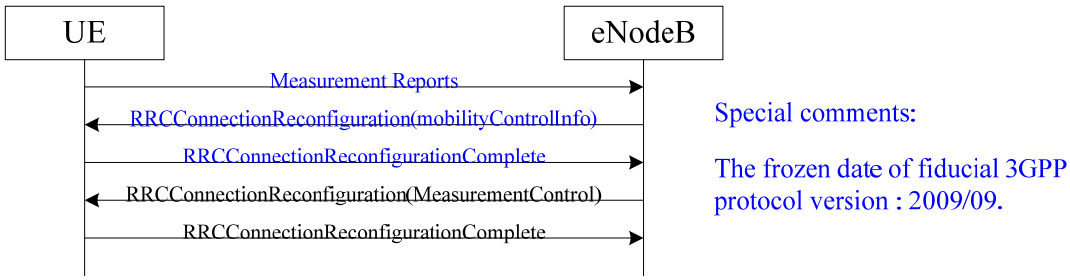
- An intra-cell handover procedure shall be initiated by the eNB when a PDCP COUNTs is about to be re-used with the same Radio Bearer identity and with the same KeNB, and the KeNB is re-freshed w.r.t. the RRC and UP COUNT after the procedure.

Reference:

23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

33.401: 3GPP System Architecture Evolution (SAE); Security architecture;

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification.



Inter-Cell Handover procedure:

The procedure is used to hand over a UE from a source cell to a target cell in the same eNodeB. In the procedure the MME and the eNodeB is unchanged, and it is not required to change the AS security algorithm during intra-eNB handover.

Reference:

23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

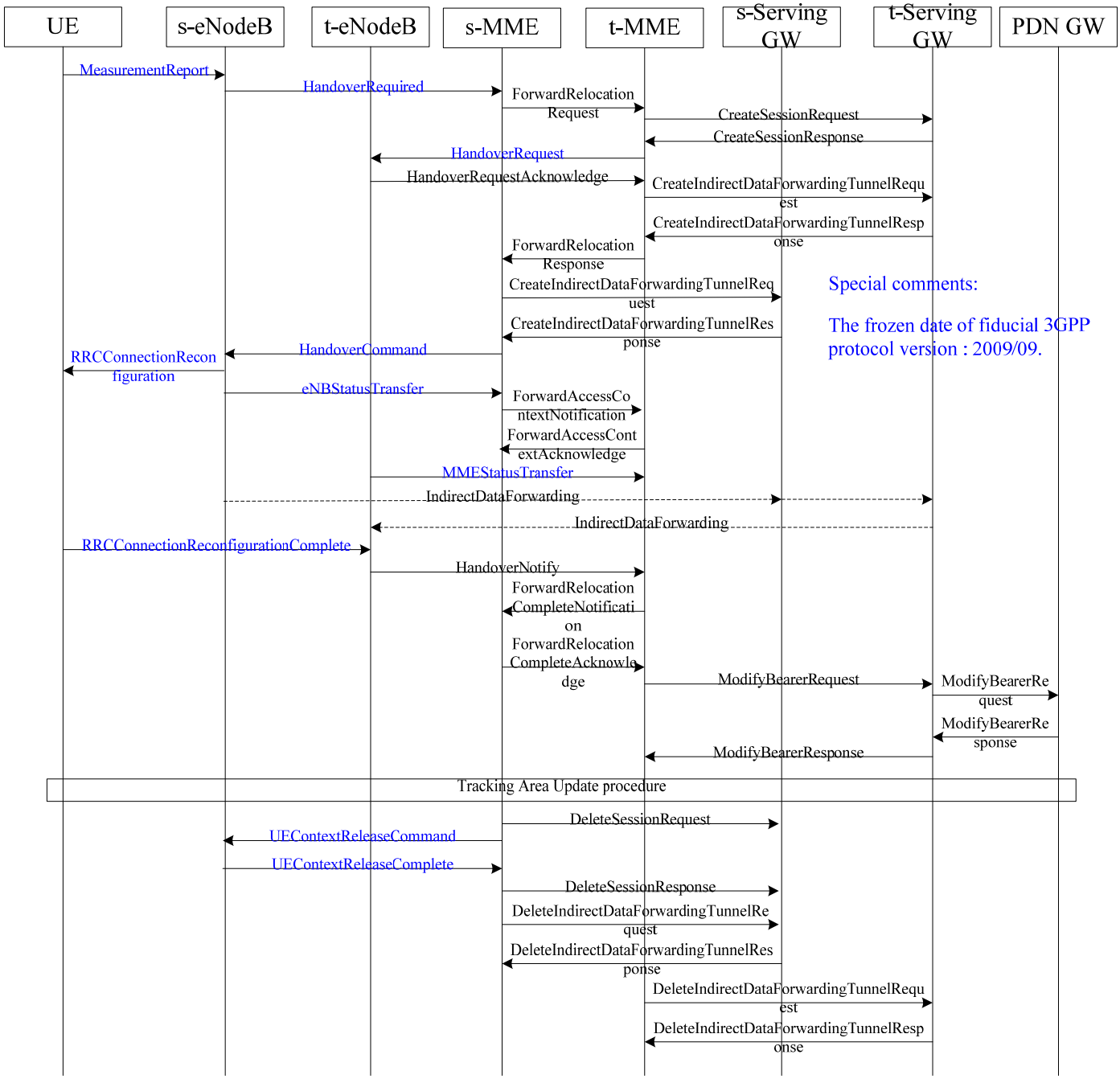
33.401: 3GPP System Architecture Evolution (SAE); Security architecture;

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification;

36.423: Evolved Universal Terrestrial Radio Access (E-UTRA) ; X2 application protocol (X2AP);

36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

eNodeB间S1接口切换流程



S1-based handover procedure:

The S1-based handover procedure is used when the X2-based handover cannot be used. The source eNodeB initiates a handover by sending Handover Required message over the S1-MME reference point. This procedure may relocate the MME and/or the Serving GW. The source MME selects the target MME. The MME should not be relocated during inter-eNodeB handover unless the UE leaves the MME Pool Area where the UE is served. The MME (target MME for MME relocation) determines if the Serving GW needs to be relocated. If the Serving GW needs to be relocated the MME selects the target Serving GW.

The source eNodeB decides which of the EPS bearers are subject for forwarding of packets from the source eNodeB to the target eNodeB. The EPC does not change the decisions taken by the RAN node. Packet forwarding can take place either directly from the source eNodeB to the target eNodeB, or indirectly from the source eNodeB to the target eNodeB via the source and target Serving GWs (or if the Serving GW is not relocated, only the single Serving GW).

The availability of a direct forwarding path is determined in the source eNodeB and indicated to the source MME. If X2 connectivity is available between the source and target eNodeBs, a direct forwarding path is available.

If a direct forwarding path is not available, indirect forwarding may be used. The source MME uses the indication from the source eNodeB to determine whether to apply indirect forwarding. The source MME indicates to the target MME whether indirect forwarding should apply. Based on this indication, the target MME determines whether it applies indirect forwarding.

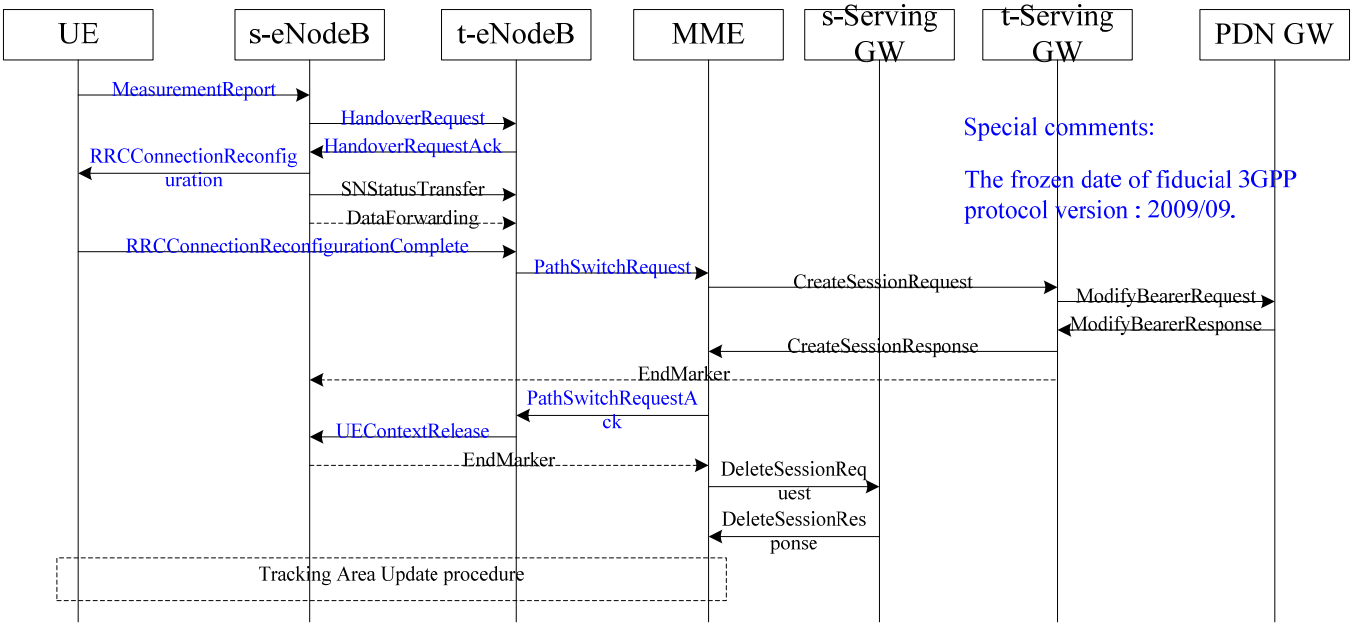
Reference:

23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification;

36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

eNodeB间X2接口切换流程



X2-based handover with Serving GW relocation

X2-based handover with Serving GW relocation procedure:

The procedure is used to hand over a UE from a source eNodeB to a target eNodeB using the X2 reference point. In the procedure the MME is unchanged. In addition to the X2 reference point between the source and target eNodeB, the procedures rely on the presence of S1-MME reference point between the MME and the source eNodeB as well as between the MME and the target eNodeB.

The handover preparation and execution phases are performed as specified in TS 36.300 [5]. If emergency bearer services are ongoing for the UE handover to the target eNodeB is performed independent of the Handover Restriction List. The MME checks, as part of the Tracking Area Update in the execution phase, if the handover is to a restricted area and if so MME releases the non-emergency bearers .

When the UE receives the handover command it will remove any EPS bearers for which it did not receive the corresponding EPS radio bearers in the target cell. As part of handover execution, downlink packets are forwarded from the source eNodeB to the target eNodeB. When the UE has arrived to the target eNodeB, downlink data forwarded from the source eNodeB can be sent to it. Uplink data from the UE can be delivered via the (source) Serving GW to the PDN GW. Only the handover completion phase is affected by a potential change of the Serving GW, the handover preparation and execution phases are identical.

If the MME receives a rejection to a NAS procedure (e.g. dedicated bearer establishment/modification/release; location reporting control; NAS message transfer; etc.) from the eNodeB with an indication that an X2 handover is in progress (see TS 36.300 [5]), the MME shall reattempt the same NAS procedure either when the handover is complete or the handover is deemed to have failed. The failure is known by expiry of the timer guarding the NAS procedure.

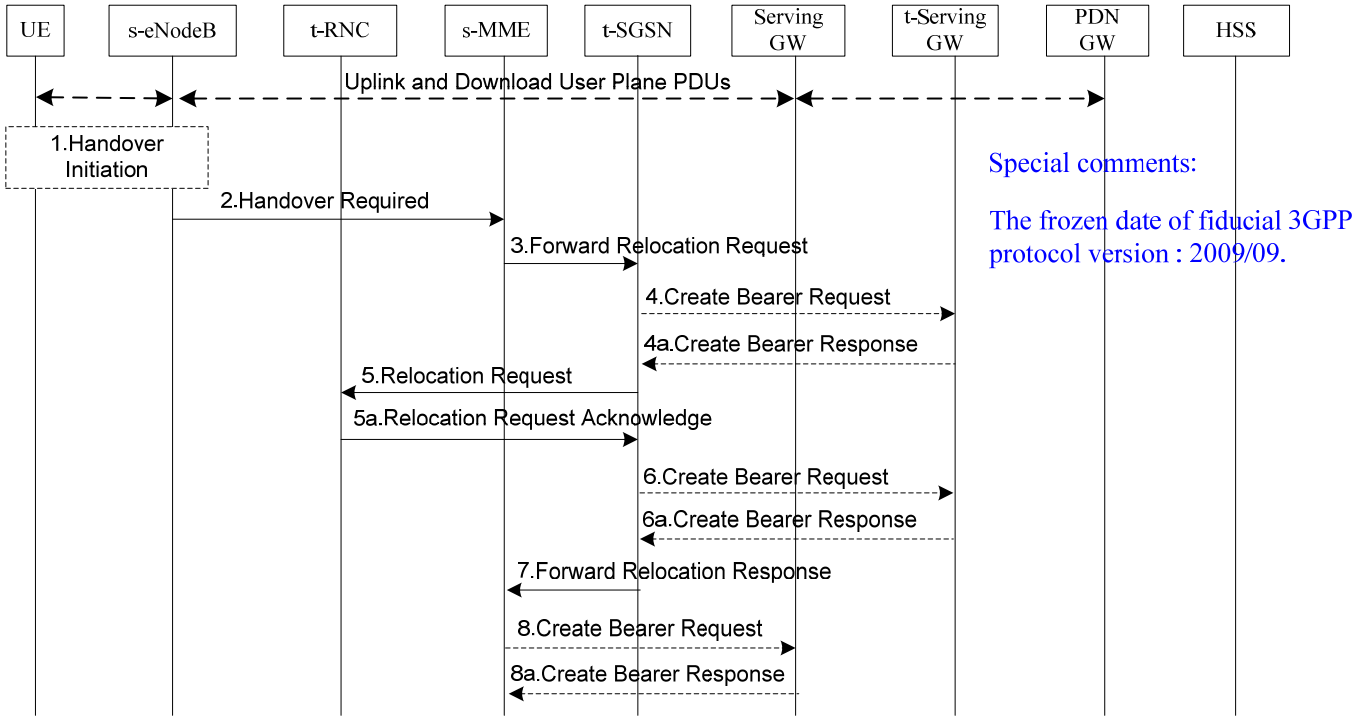
Reference:

23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification;

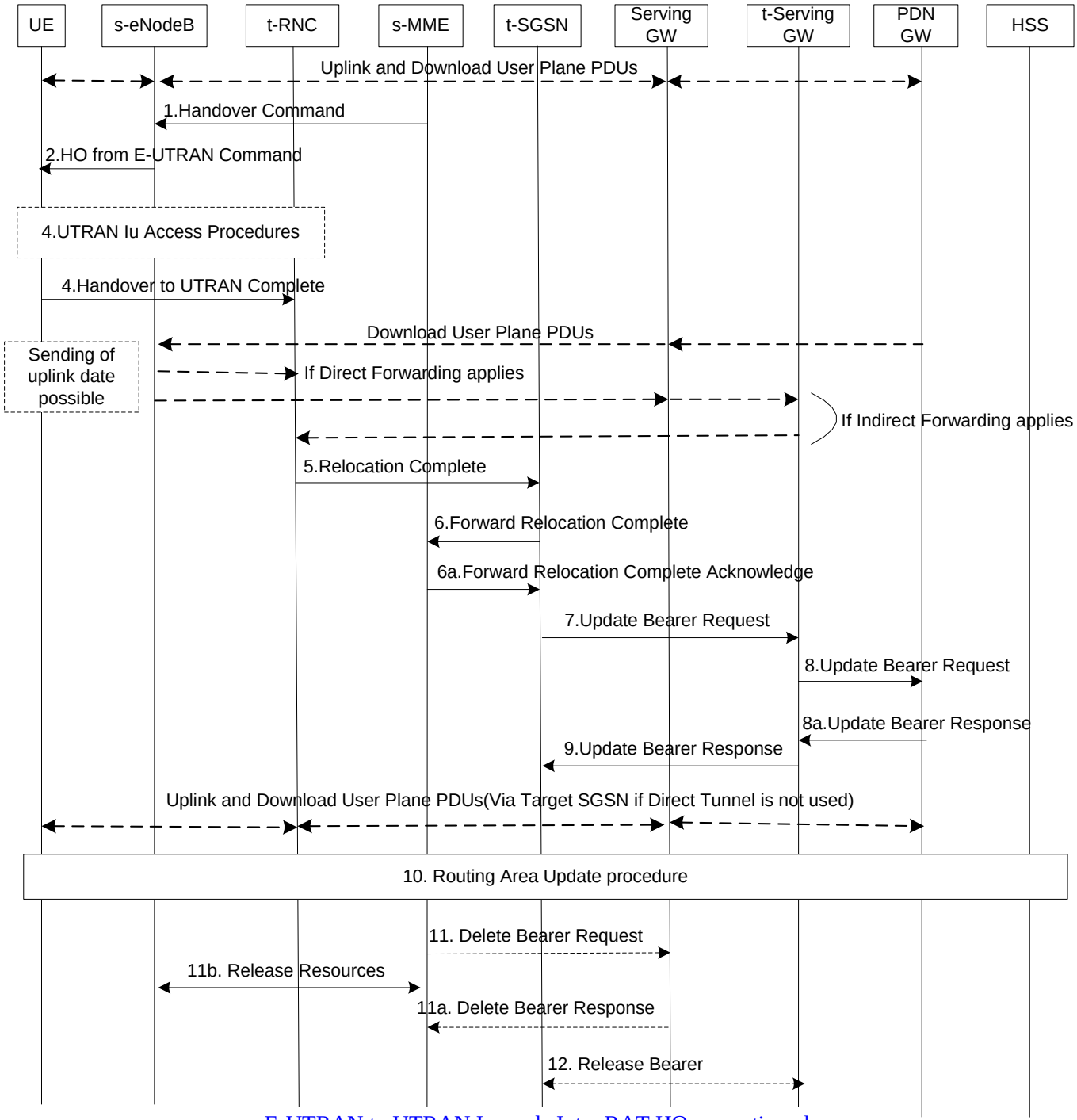
36.423: Evolved Universal Terrestrial Radio Access (E-UTRA) ; X2 application protocol (X2AP).

LTE2UTRAN切换流程



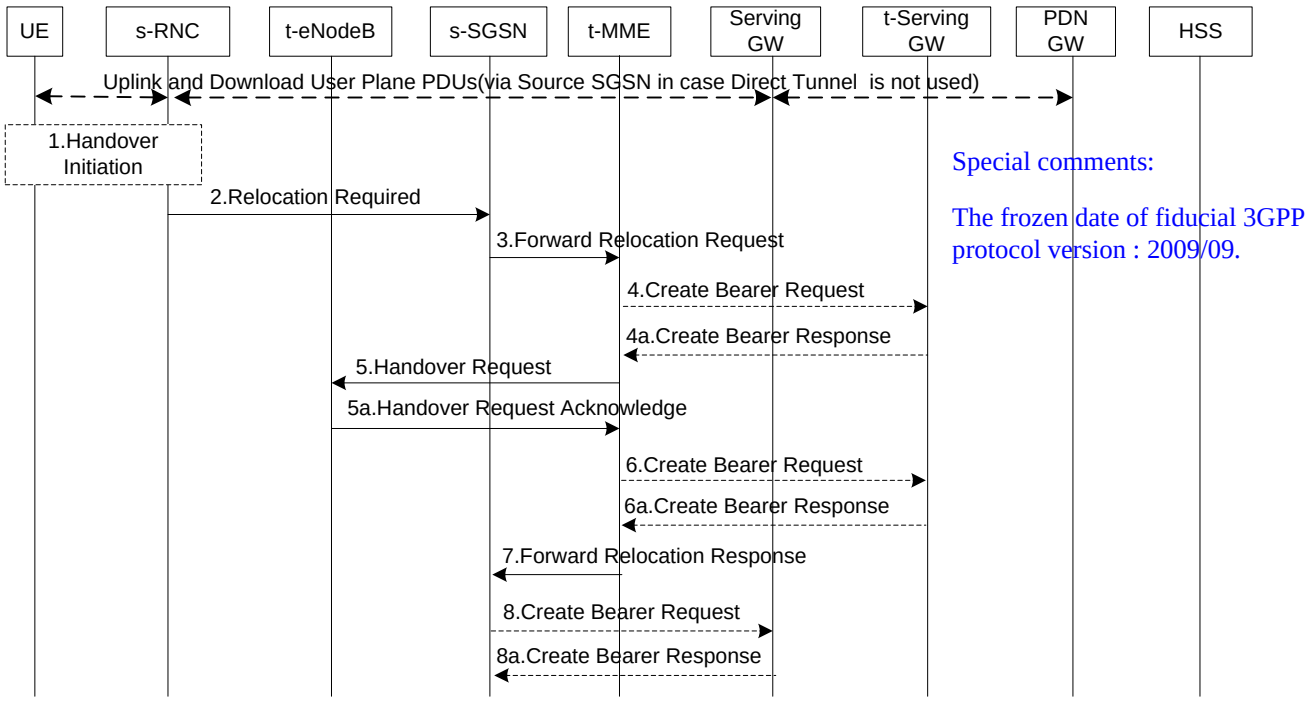
E-UTRAN to UTRAN Iu mode Inter RAT HO, preparation phase

LTE2UTRAN切换流程



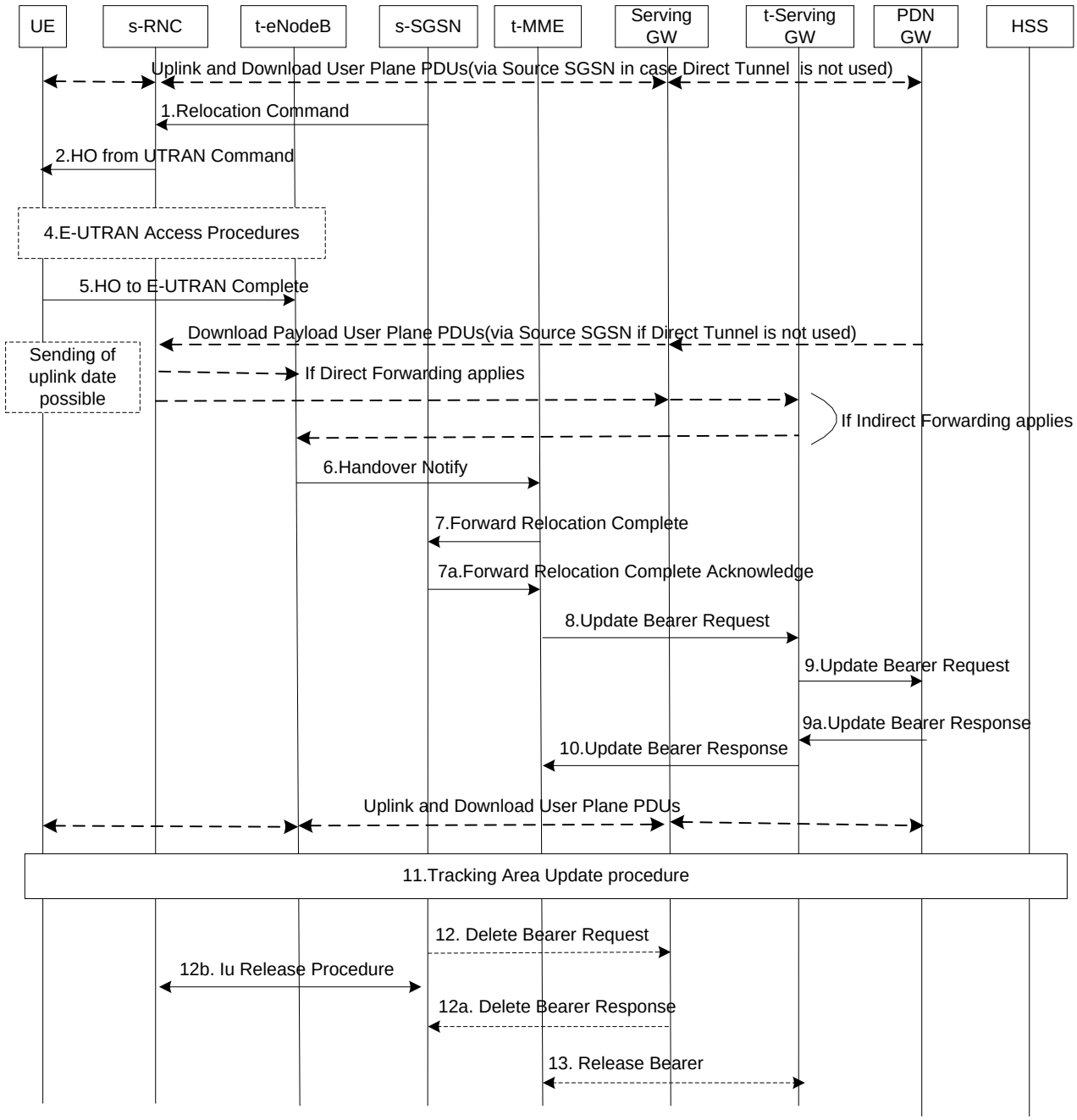
E-UTRAN to UTRAN Iu mode Inter RAT HO, execution phas

UTRANS2LTE切换流程



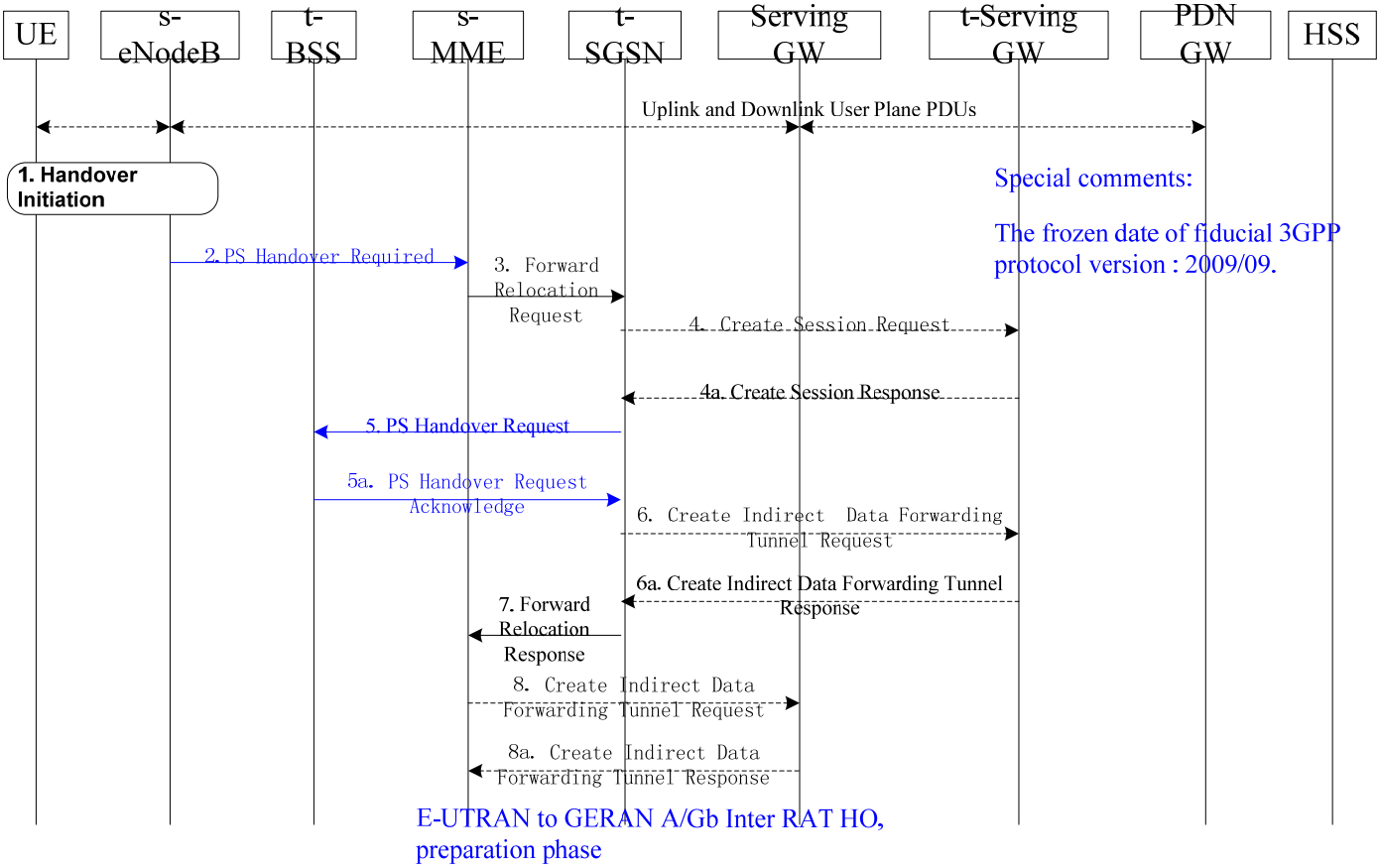
UTRAN Iu mode to E-UTRAN Inter RAT HO, preparation phase

UTRANS2LTE切换流程

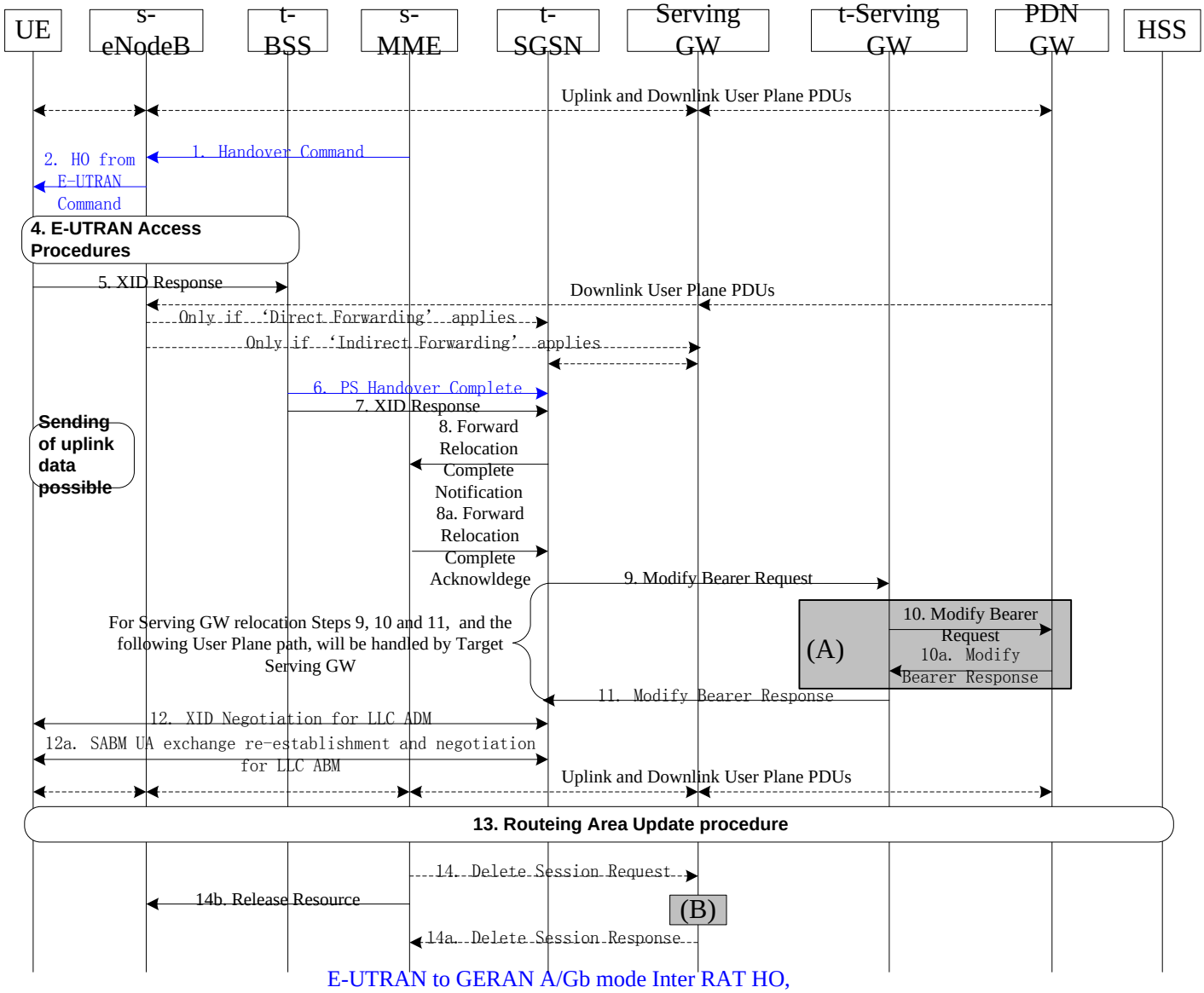


UTRAN Iu mode to E-UTRAN Inter RAT HO, execution phase

LTE2GERAN切换流程

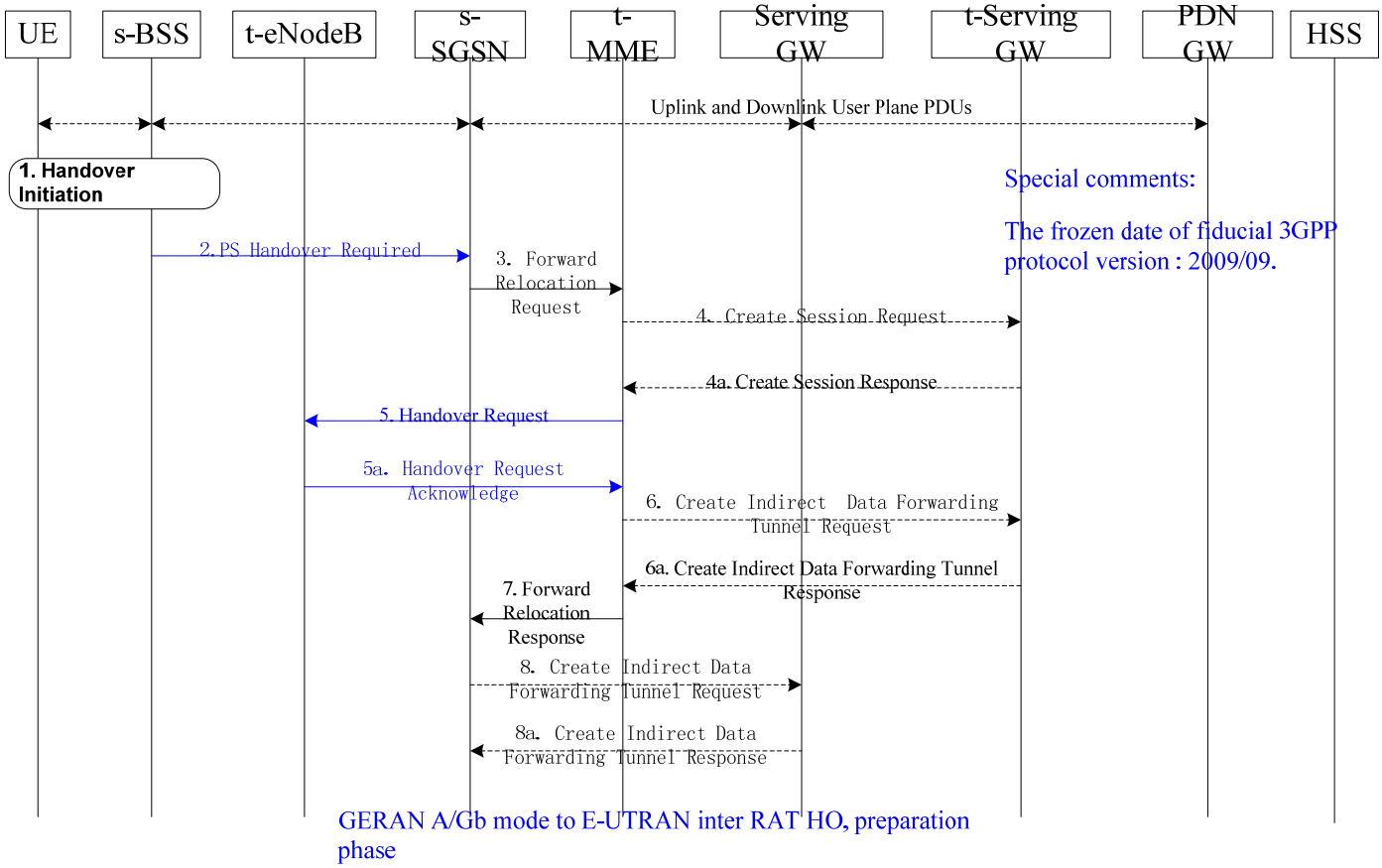


LTE2GERAN切换流程



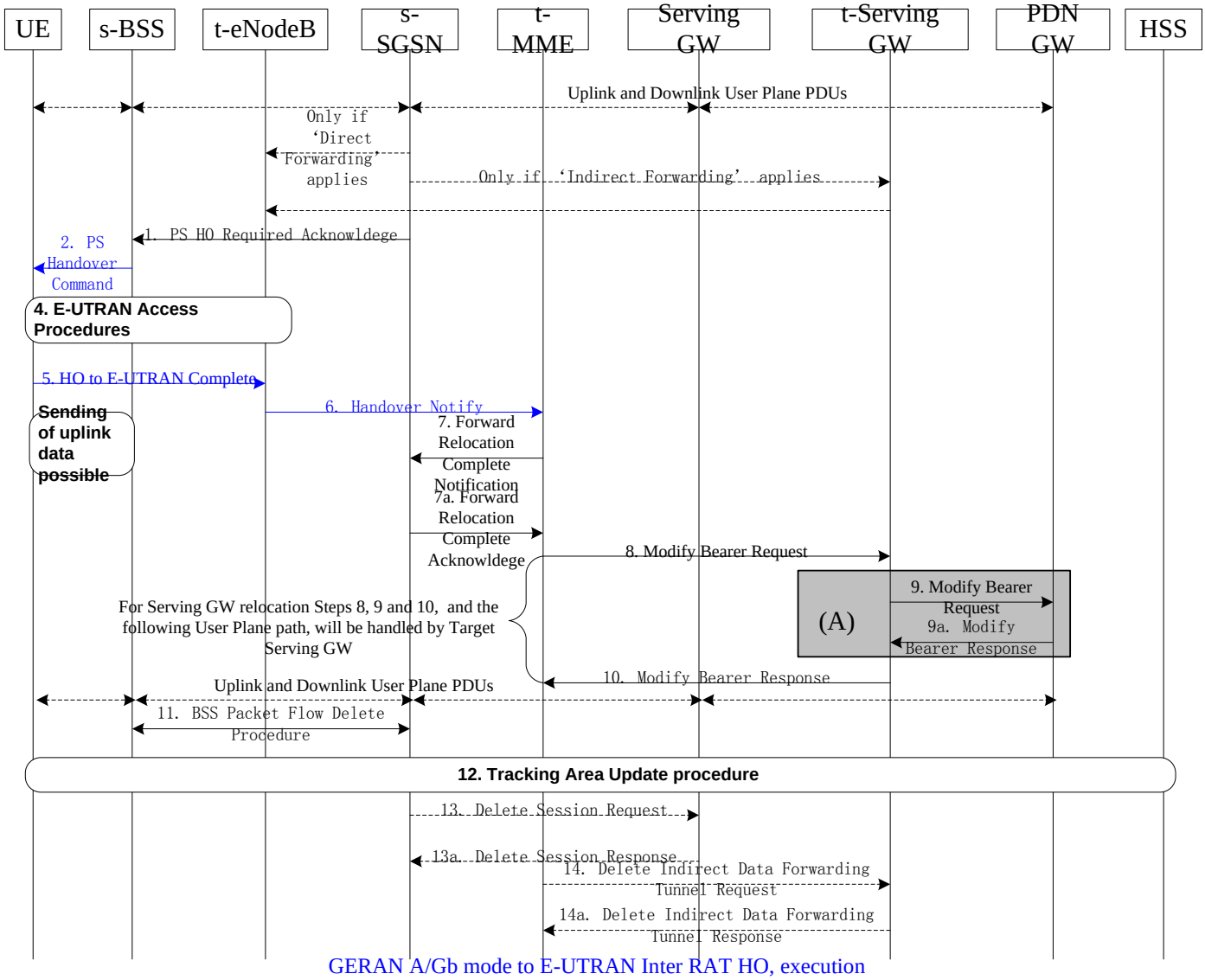
E-UTRAN to GERAN A/Gb mode Inter RAT HO, execution phase

GERAN2LTE切换流程



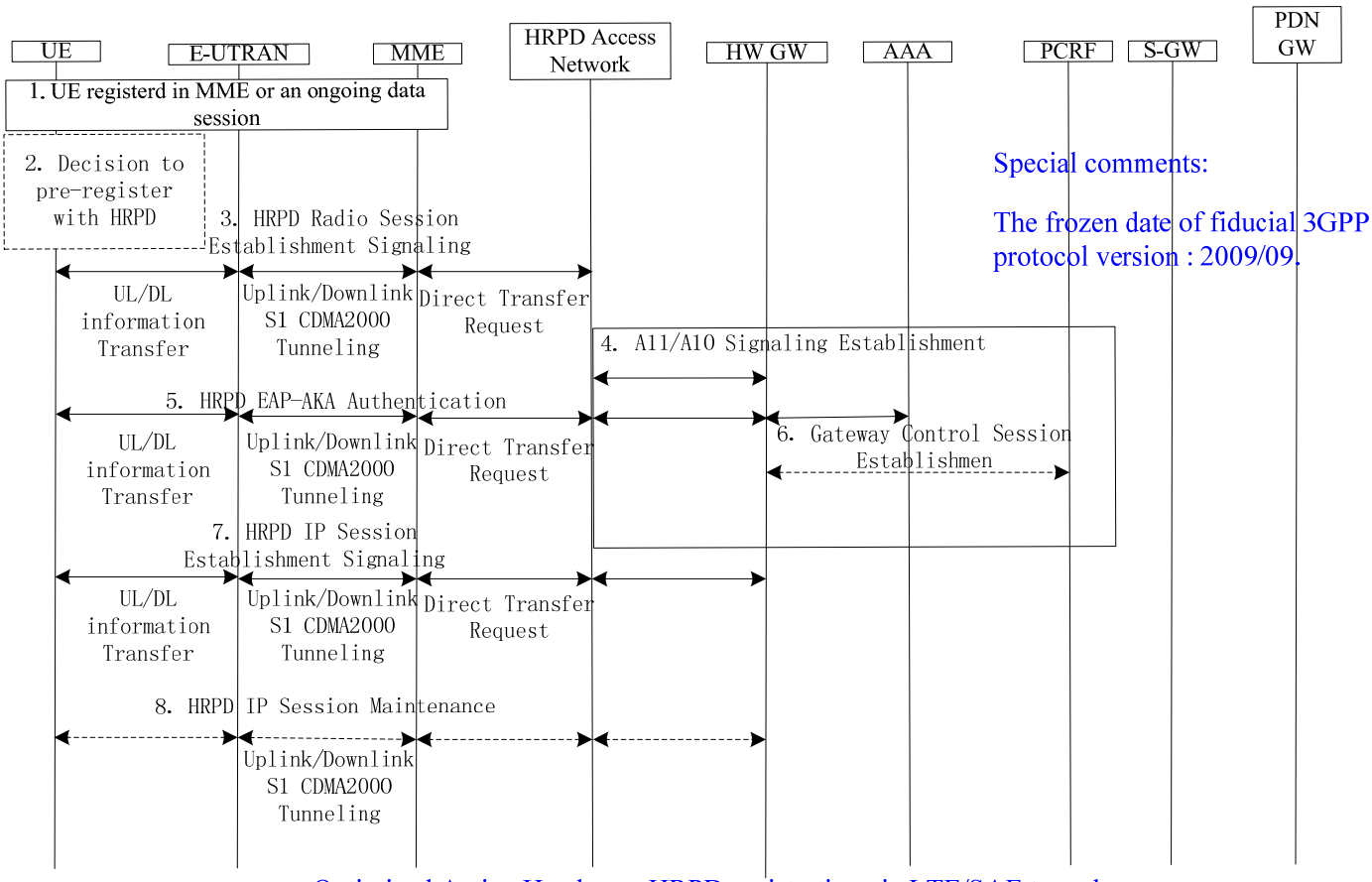
GERAN A/Gb mode to E-UTRAN inter RAT HO, preparation phase

GERAN2LTE切换流程



GERAN A/Gb mode to E-UTRAN Inter RAT HO, execution phase

LTE2CDMA切换流程（优化）

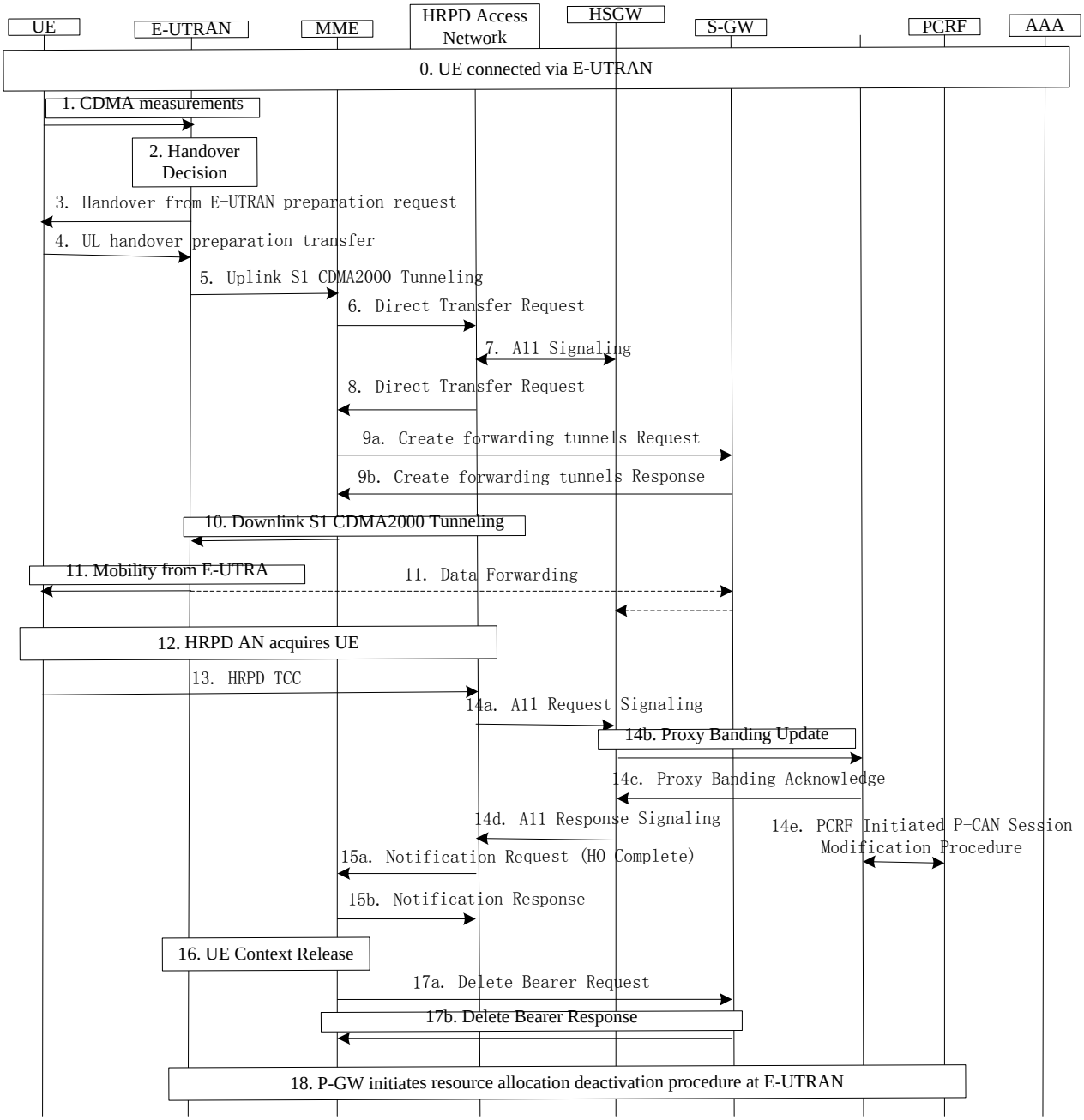


Special comments:

The frozen date of fiducial 3GPP protocol version : 2009/09.

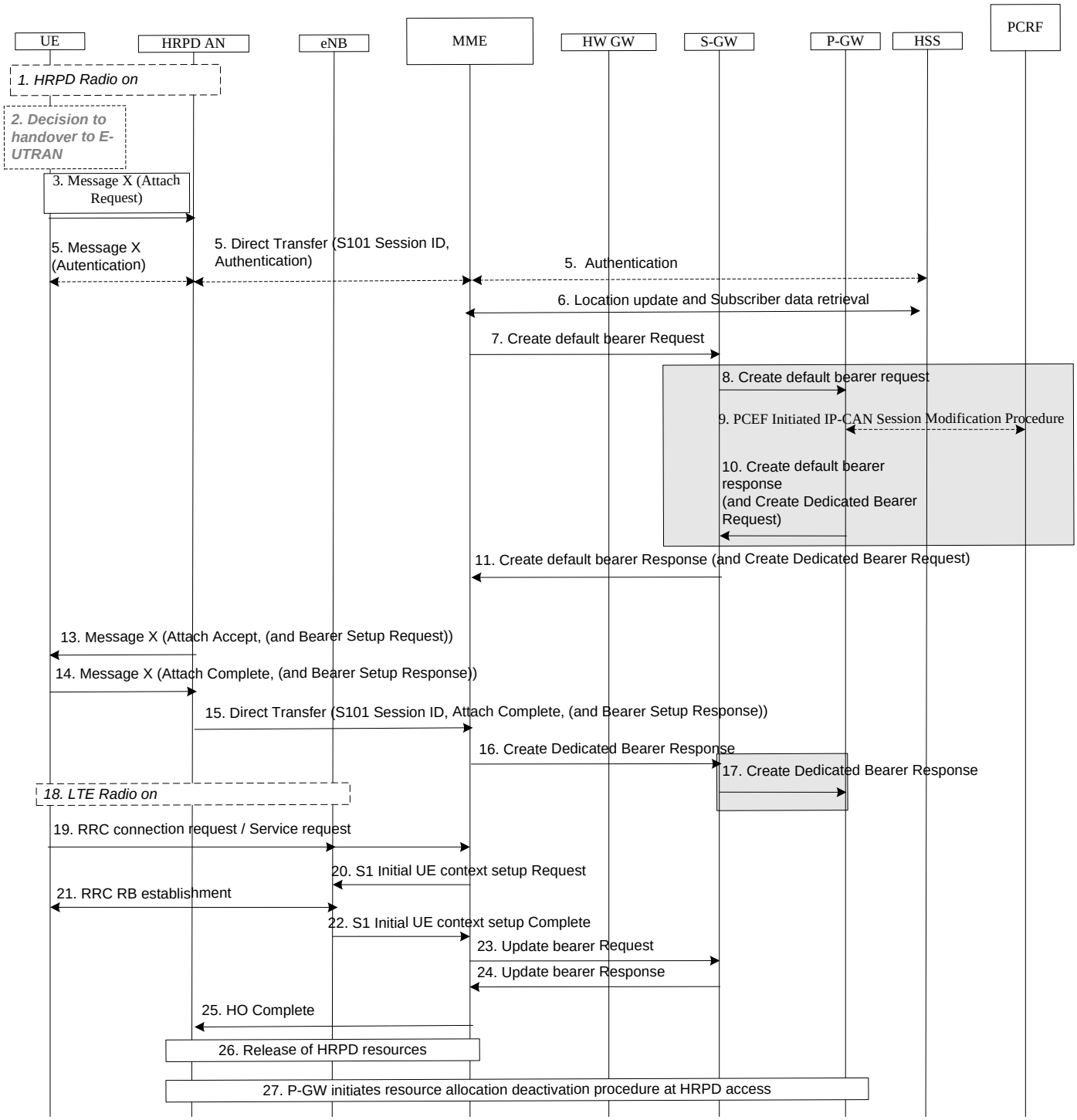
Optimized Active Handover: HRPD registration via LTE/SAE tunnel

LTE2CDMA切换流程（优化）



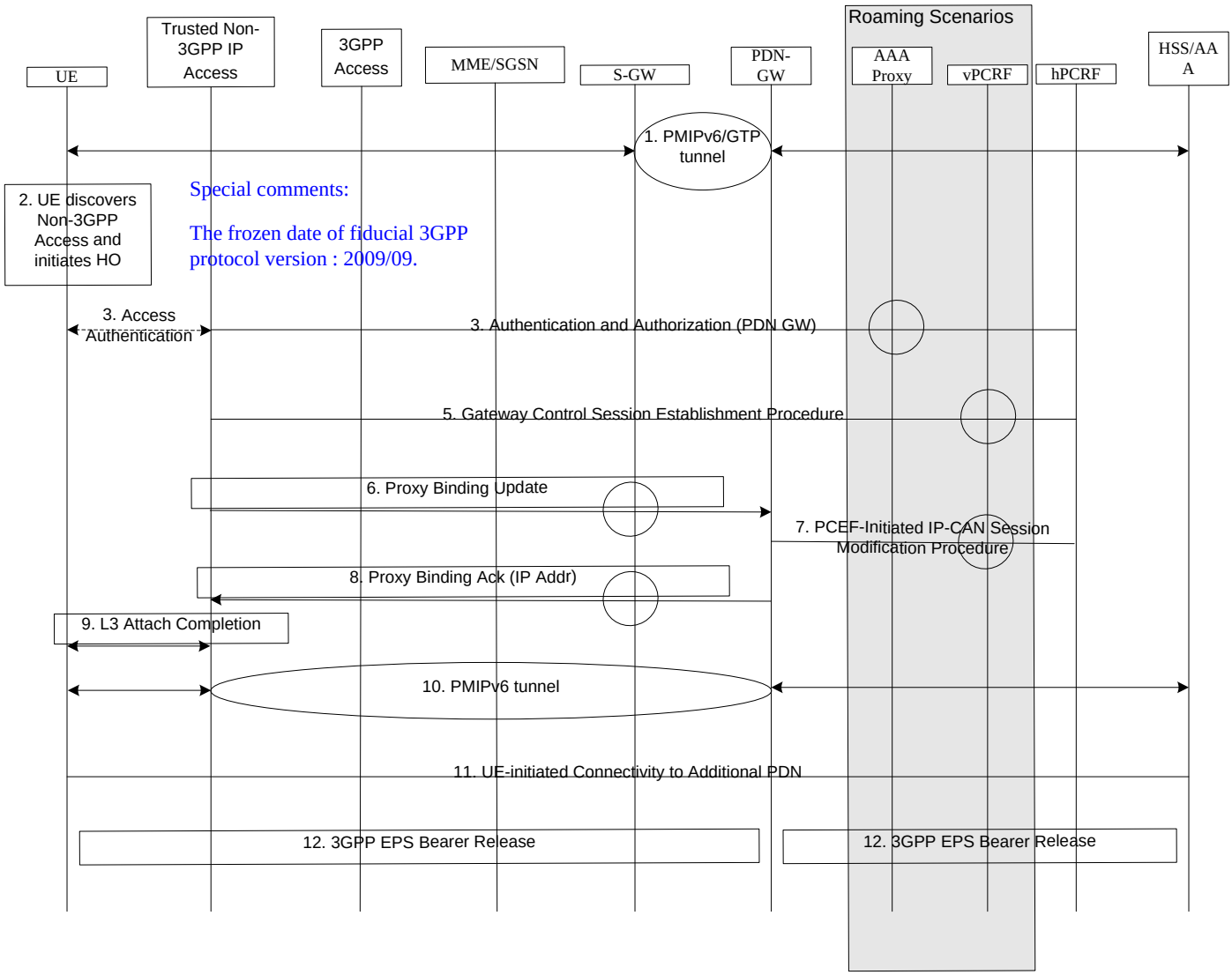
Optimized Active Handover: E-UTRAN to HRPD handover

CDMA2LTE切换流程（优化）



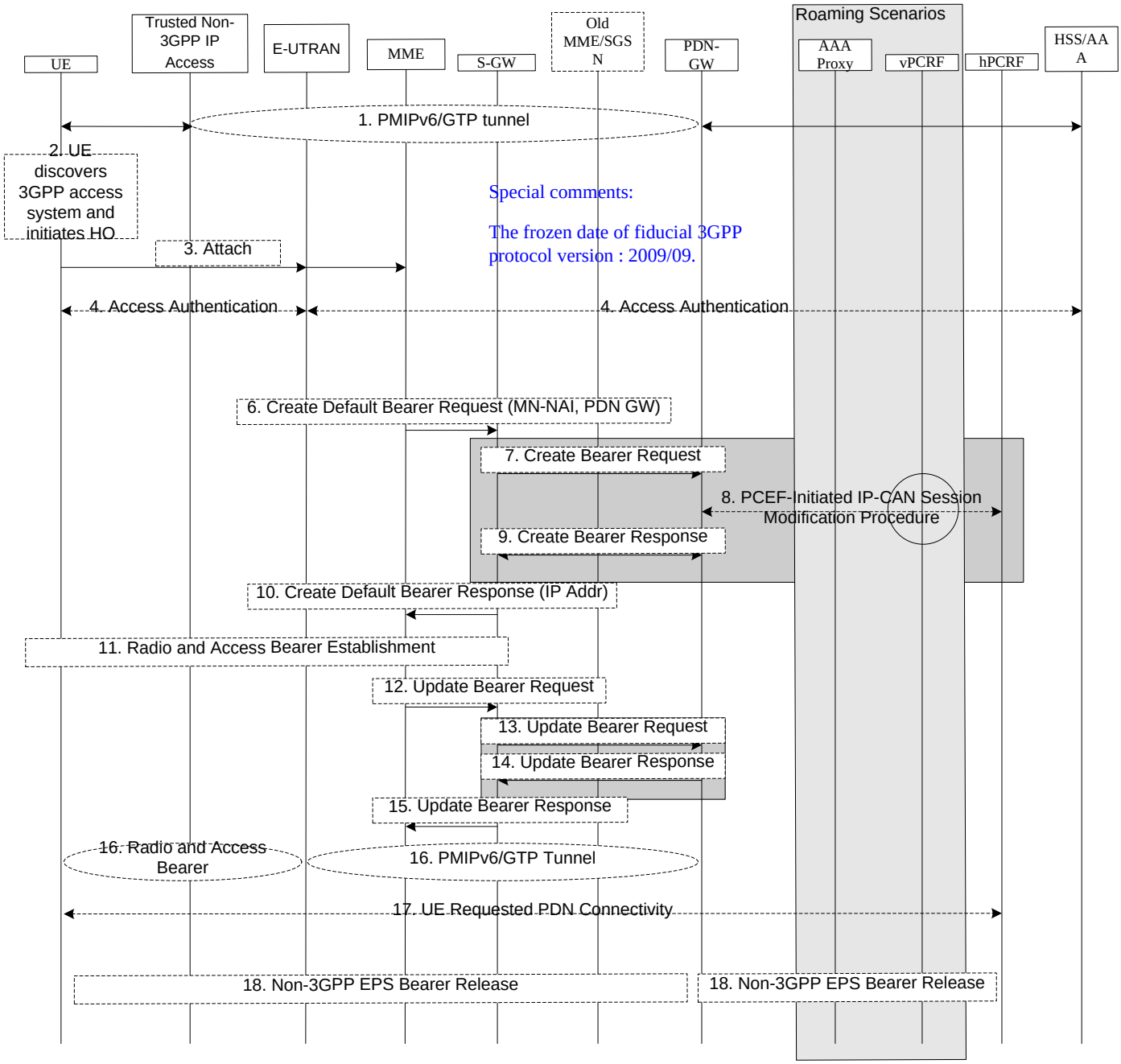
HRPD to EUTRAN handover with GTP-based S5/S8

LTE2CDMA切换流程（非优化）



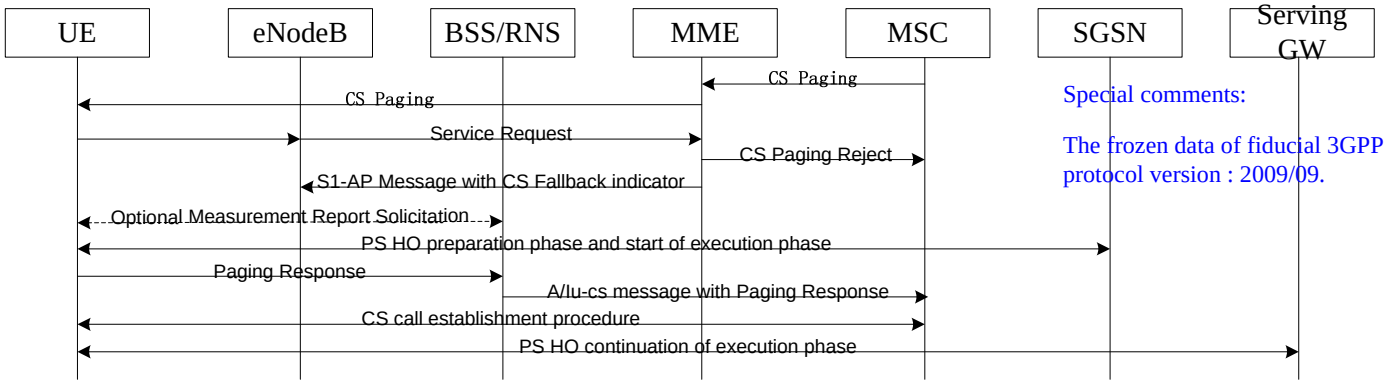
Handover from 3GPP Access to Trusted Non-3GPP IP Access with PMIPv6 on S2a and PMIPv6 or GTP on S5 interface

CDMA2LTE切换流程（非优化）



Handover from Trusted or Untrusted Non-3GPP IP Access to E-UTRAN with PMIP on S2a or S2b or MIPv4 on S2a and GTP on S5/S8 interfaces

CSFB流程（PSHO）



E-UTRAN To GSM/UMTS CSFB procedure（Mobile Terminating call in active mode With PSHO）**：**

The CS fallback in EPS enables the provisioning of voice and other CS-domain services (e.g. CS UDI video/ SMS/ LCS/ USSD) by reuse of CS infrastructure when the UE is served by E–UTRAN. A CS fallback enabled terminal, connected to E–UTRAN may use GERAN or UTRAN to connect to the CS–domain. This function is only available in case E–UTRAN coverage is overlapped by either GERAN coverage or UTRAN coverage.

CS Fallback and IMS–based services shall be able to co-exist in the same operator's network.

Reference:

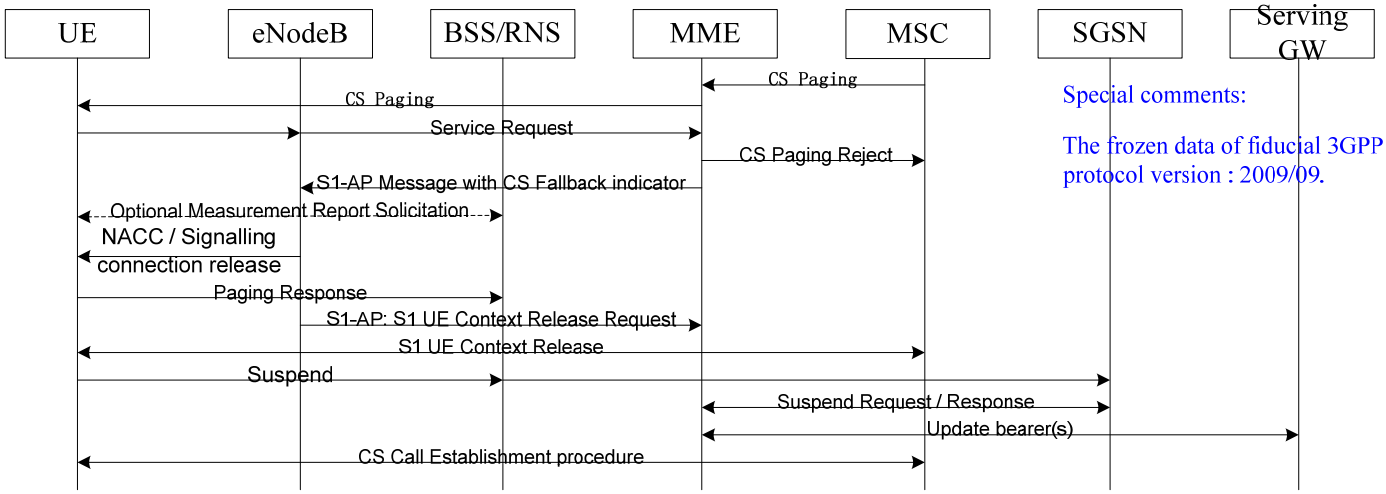
23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

23.272: 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects;

Circuit Switched Fallback in Evolved Packet System;

36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

CSFB流程（non-PSHO）



E-UTRAN To GSM/UMTS CSFB procedure（Mobile Terminating call in active mode No PSHO）：

The CS fallback in EPS enables the provisioning of voice and other CS-domain services (e.g. CS UDI video/ SMS/ LCS/ USSD) by reuse of CS infrastructure when the UE is served by E−UTRAN. A CS fallback enabled terminal, connected to E−UTRAN may use GERAN or UTRAN to connect to the CS−domain. This function is only available in case E−UTRAN coverage is overlapped by either GERAN coverage or UTRAN coverage.

CS Fallback and IMS−based services shall be able to co-exist in the same operator's network.

Reference:

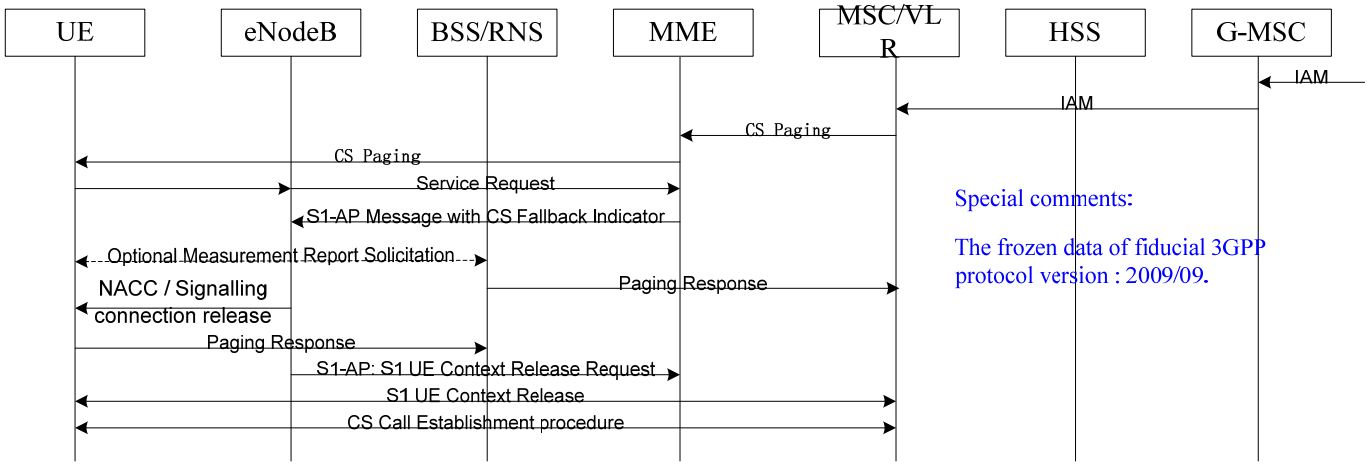
23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

23.272: 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects;

Circuit Switched Fallback in Evolved Packet System;

36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

CSFB流程（IDLE）



E-UTRAN To GSM/UMTS CSFB procedure（Mobile Terminating call in idle mode）：

The CS fallback in EPS enables the provisioning of voice and other CS-domain services (e.g. CS UDI video/ SMS/ LCS/ USSD) by reuse of CS infrastructure when the UE is served by E−UTRAN. A CS fallback enabled terminal, connected to E−UTRAN may use GERAN or UTRAN to connect to the CS−domain. This function is only available in case E−UTRAN coverage is overlapped by either GERAN coverage or UTRAN coverage.

CS Fallback and IMS−based services shall be able to co-exist in the same operator's network.

Reference:

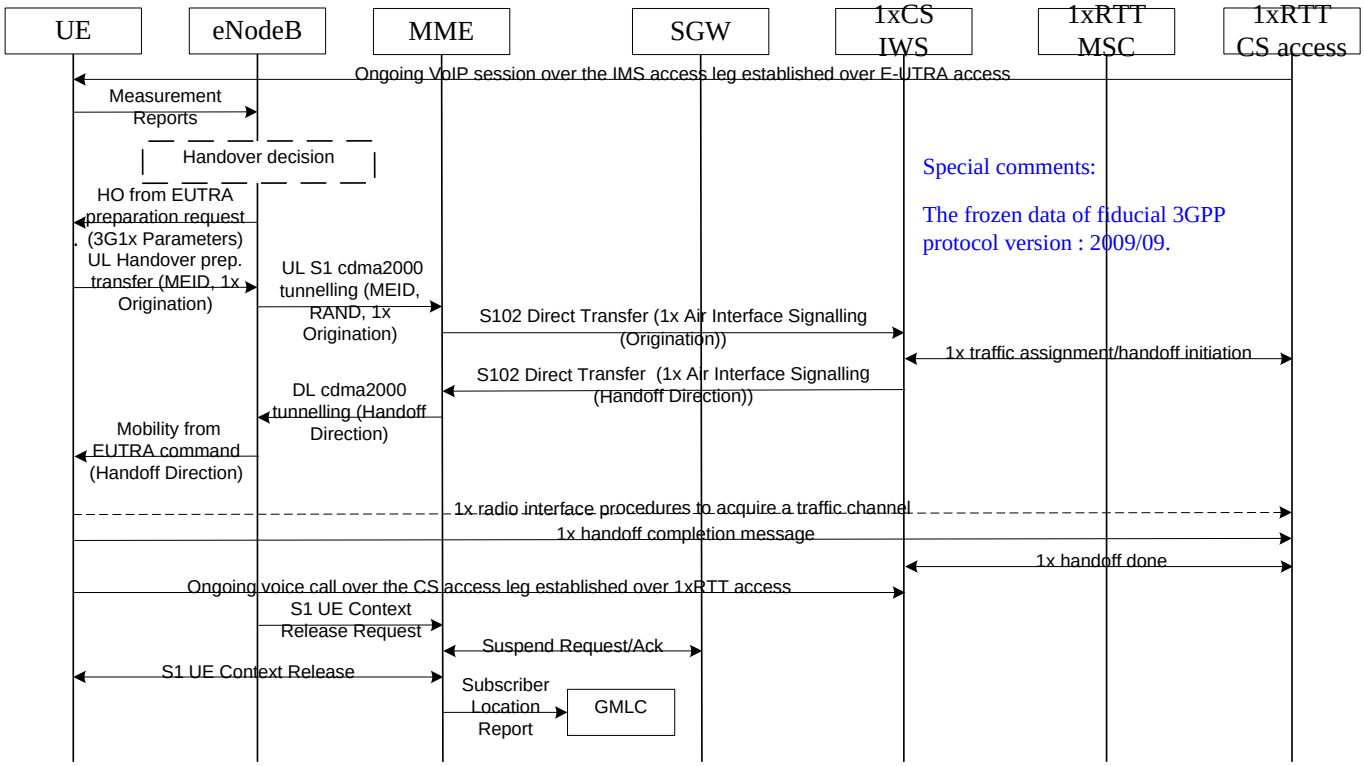
23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

23.272: 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects;

Circuit Switched Fallback in Evolved Packet System;

36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

SRVCC流程（CDMA）



E-UTRAN To CDMA 1XRTT SRVCC procedure:

For SRVCC-capable UEs, the call is always anchored at the VCC AS in the 3GPP2's IMS. The 3GPP2 1xCS IWS enables a single radio UE to communicate in parallel both with the source system and the target system. From VCC perspective, this mechanism minimizes the voice gap by supporting the transport of signalling for establishment of the target CS access leg while the terminal is connected to the source PS access network.

Reference:

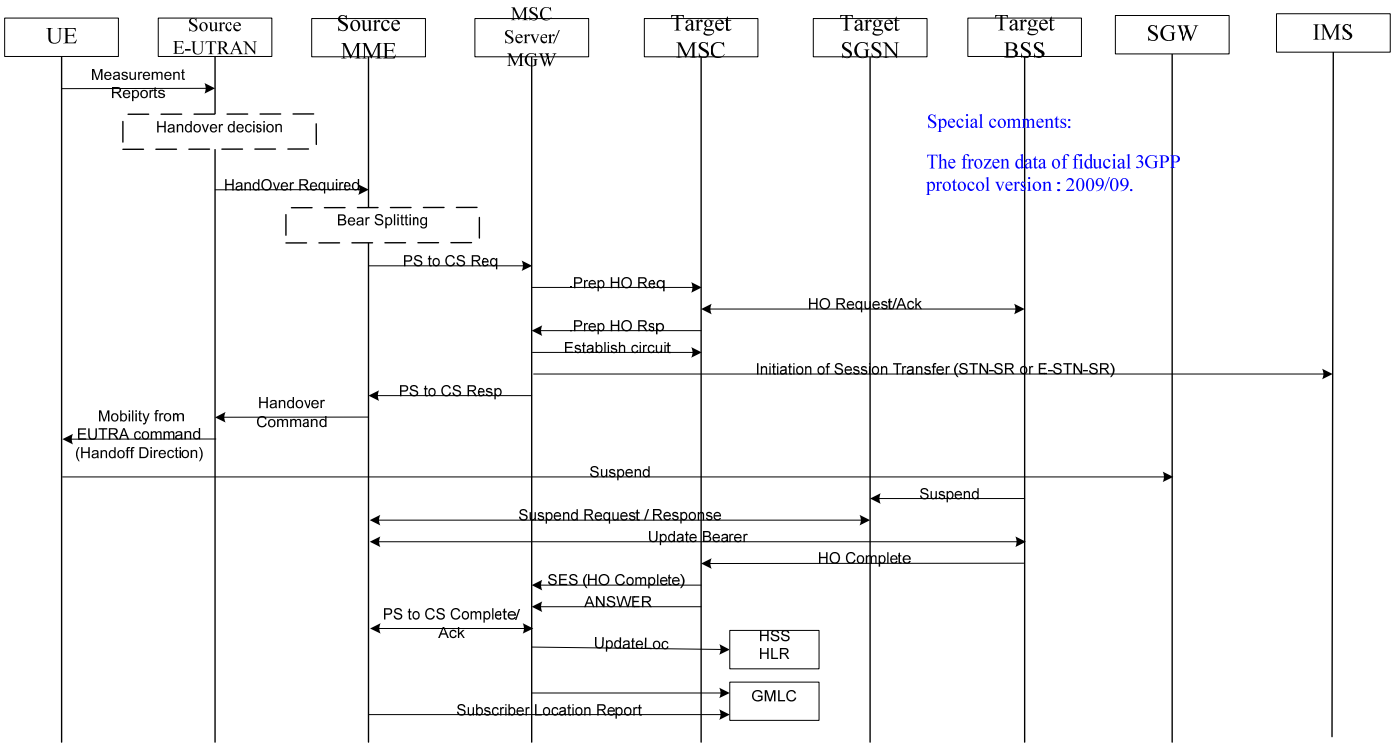
23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

23.216: 3rd Generation Partnership Project;Technical Specification Group Services and System Aspects;

Single Radio Voice Call Continuity (SRVCC)

36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

SRVCC流程（GERAN/UMTS）



E-UTRAN To GERAN/UMTS SRVCC procedure:

For SRVCC from E−UTRAN to UTRAN/GERAN, MME first receives the handover request from E−UTRAN with the indication that this is for SRVCC handling, and then triggers the SRVCC procedure with the MSC Server enhanced with SRVCC via the Sv reference point if MME has SRVCC STN-SR information for this UE. MSC Server enhanced for SRVCC then initiates the session transfer procedure to IMS and coordinates it with the CS handover procedure to the target cell. MSC Server enhanced for SRVCC then sends PS-CS handover Response to MME, which includes the necessary CS HO command information for the UE to access the UTRAN/GERAN.

Reference:

23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access;

23.216: 3rd Generation Partnership Project;Technical Specification Group Services and System Aspects;

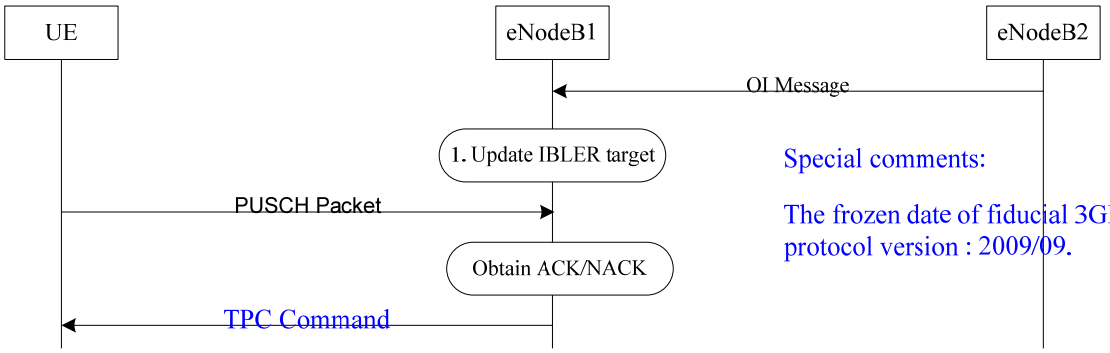
Single Radio Voice Call Continuity (SRVCC)

36.413: Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP).

闭环功控流程

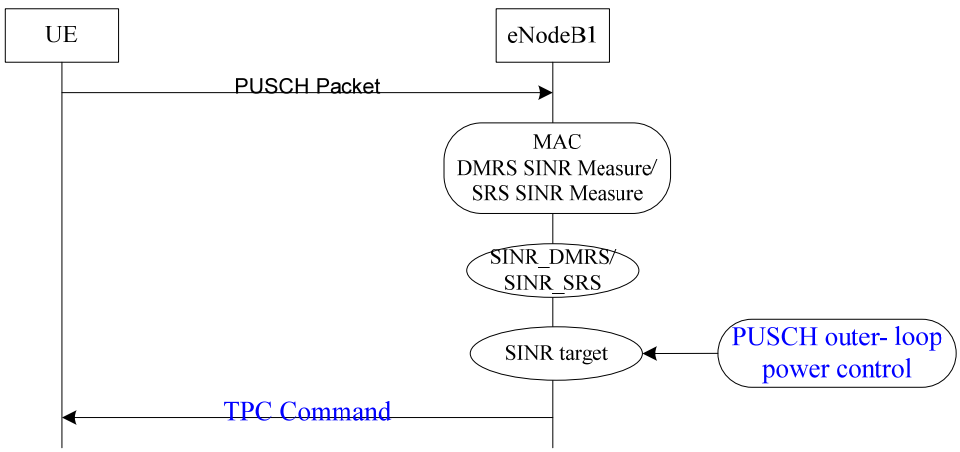
The physical uplink shared channel(PUSCH) closed-loop power control

specify the semi-persistent scheduling
closed-loop power control



1. To update serving cell IBLER target according to OI message from neighbour cells as to reduce inter-cell interference. The new cell IBLER target will be configured new UE.
2. To set TPC command based on IBLER measurement value and IBLER target value,as to assure expected IBLER leverl

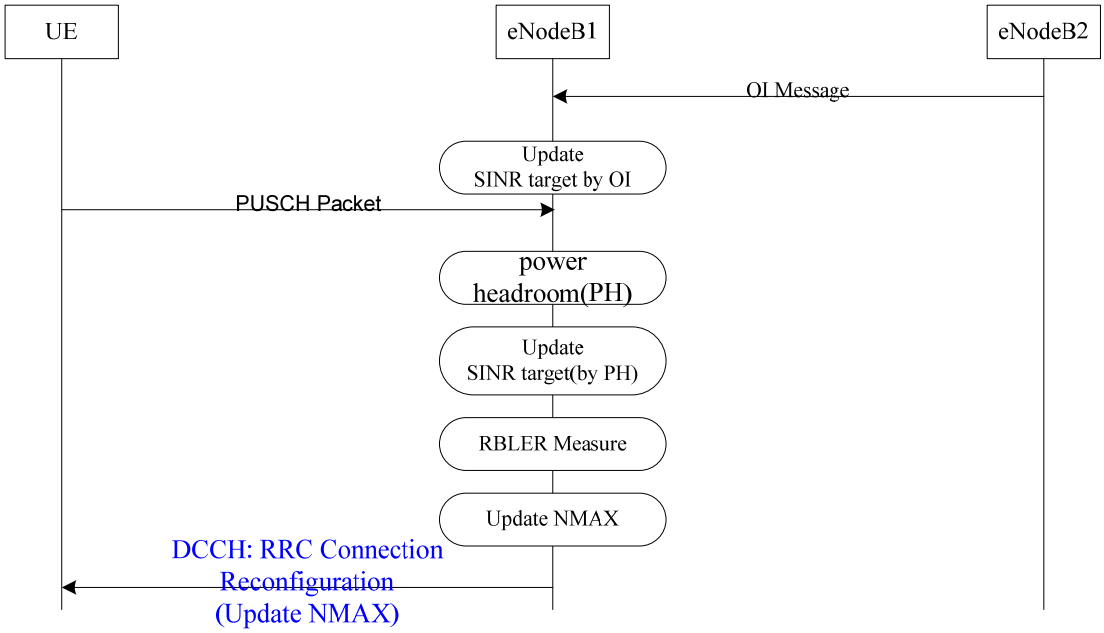
specify the non-persistent scheduling
inner-loop power control



1. To set TPC command based on SINR measurement value and SINR target value,as to assure expected SINR leverl.The SINR target value is updated according to outer-loop power control. SINR measurement value differs in DMRS / SRS measurement.

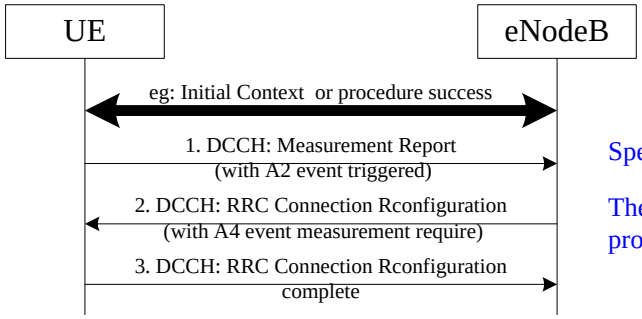
闭环功控流程

specify the non-persistent scheduling outer-loop power control



1. To update serving UE SINR target according to OI message from neighbour cells or power headroom , as to adapte to the diverse channel condition and inter-cell interference.
2. To update and config NMAX value to UE according to RBLER measurement., as to save RRC resource.

GAP测量配置流程



Special comments:

The frozen date of fiducial 3GPP protocol version : 2009/09.

GAP Measurement procedure:

1. Ue Send MeasmentReport to eNodeb to indicate A2 event trigged

2. eNodeB Judge the serving cell's signal becomes bad and need to trige Inter-Freq or Inter-Rat Measment (there should be Inter-Freq Info or Inter-Rat Freq Info of the serving cell)

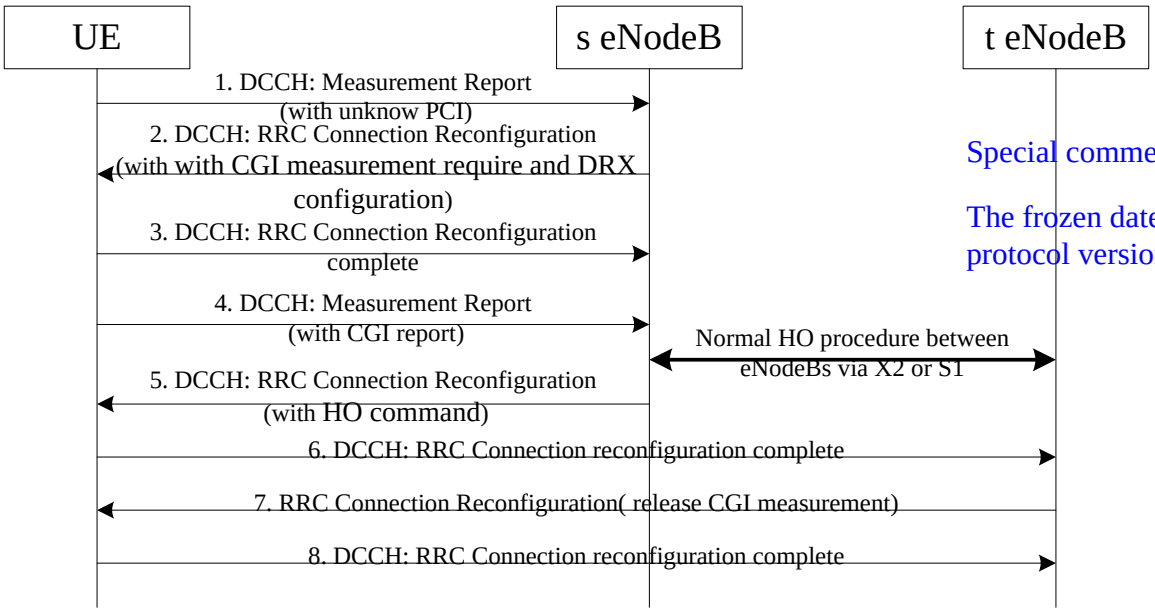
3. eNodeB send RRCConnectionReconfiguration to UE, which contain the Gap config and A4 or B1 Measment config

4. UE send RRCConnectionReconfiguration Complete to eNodeB, which means Gap config and A4 or B1 measment config is success

Reference:

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification, 5.5.2.9 Measurement gap configuration

ANR测量配置流程



Special comments:

The frozen date of fiducial 3GPP protocol version : 2009/09.

ANR Measurement procedure:

1. Ue Send MeasmentReport to eNodeB to indicate A3 or A4 event trigged, and strongest PCI is unknown(eg. the PCI belongs to another eNodeb)
2. eNodeB send a new Measment to command UE to report the CGI of the unknown PCI, and a long DRX cycle may be needed for UE to read the NCELL's SYSINFO
3. UE reads the NCELL's SIB1 to get the NCELL's CGI and reports it to eNodeb
4. SRC eNodeb send RRCConnectionReconfiguration which contains HO command to UE
5. UE random access to the Tar eNodeb
6. Tar eNodeb may send new Measment require to stop the old CGI measment

Reference:

36.331: Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification, 5.5.4 Measurement report triggering

Thank You