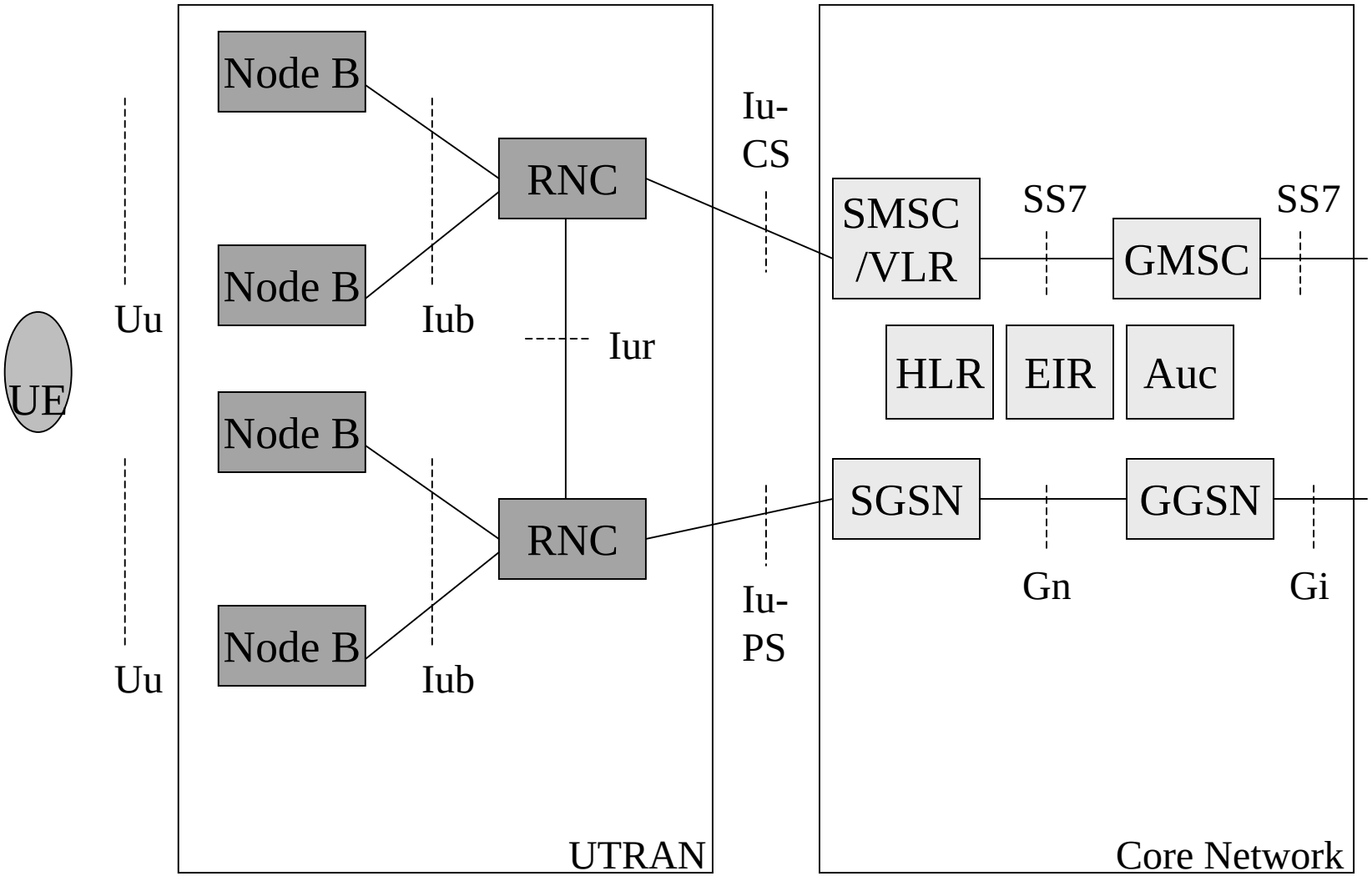
Radio Access Network Architecture

Jussi Tuominen

3GPP Release 99 Reference Architecture



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UMTS Terrestial Radio Access Network (UTRAN)

WCDMA Radio Interface Key Change from GSM

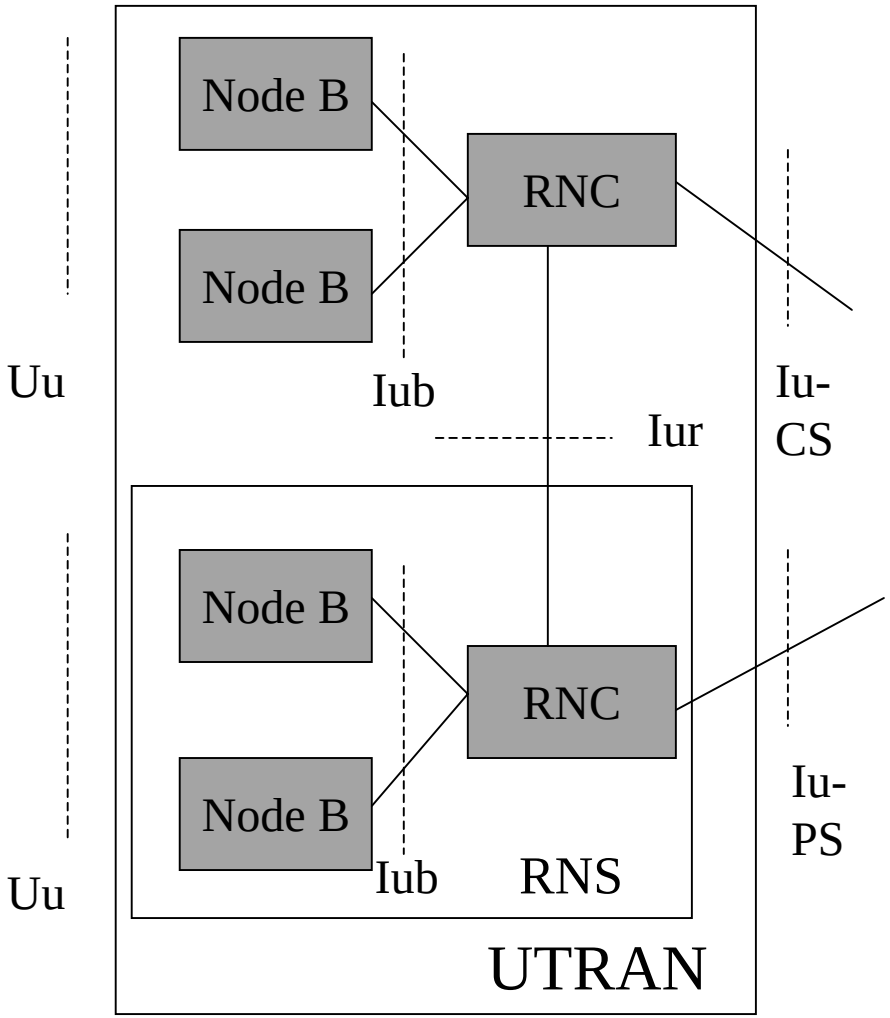
UTRAN elements are comparable to GSM BSC & BTS

Common Interface (Iu) for both PS and CS Core

Core elements do not change dramatically

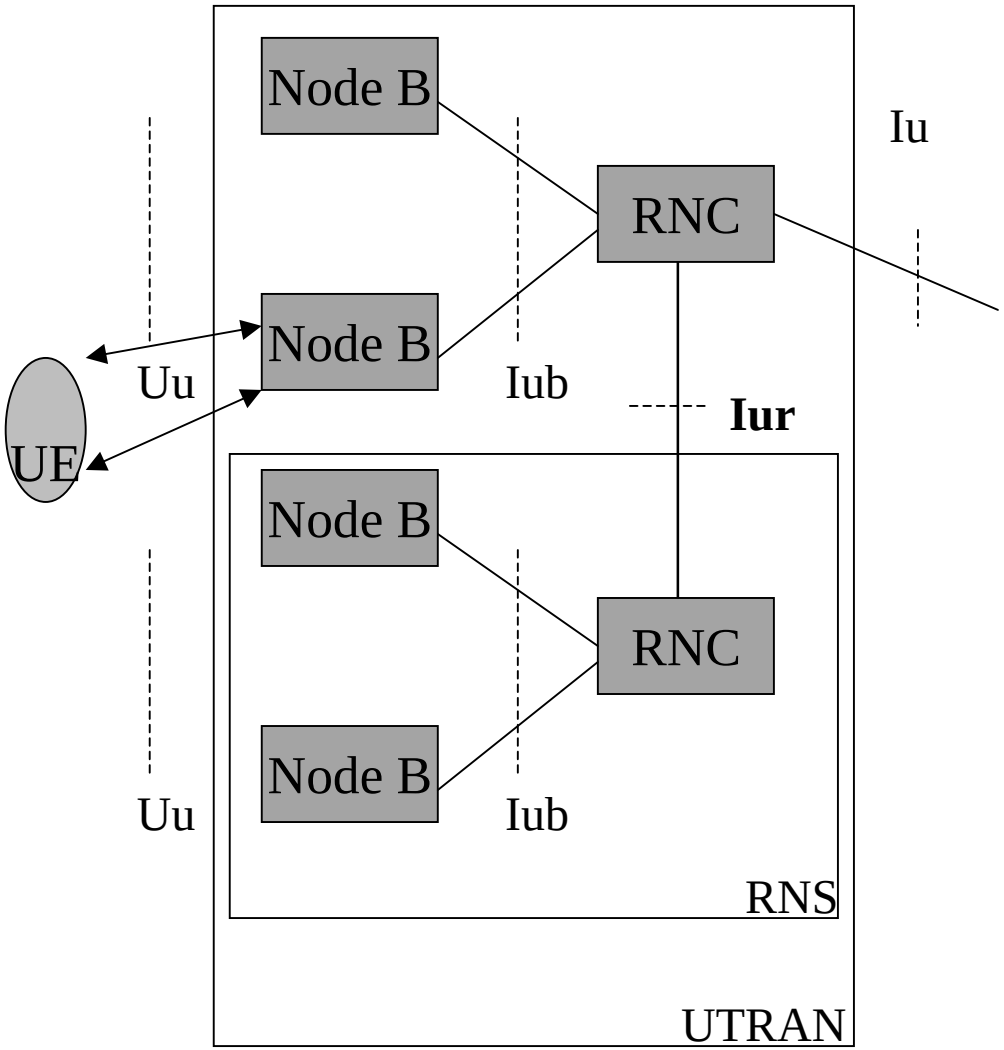
- 3G SMSC/VLR provides ATM based Iu-CS interface
- 3G SGSN supports ATM based Iu-PS interface

UTRAN Architecture



- Hierarchical Architecture
- Radio Network Subsystem (RNS)
- UTRAN Elements:
  - Radio Network Controller
  - Node B (Base Station)
- One RNC controls number of Node B's
- Node B is only connected to one RNC
- New interface Iur for Macrodiversity

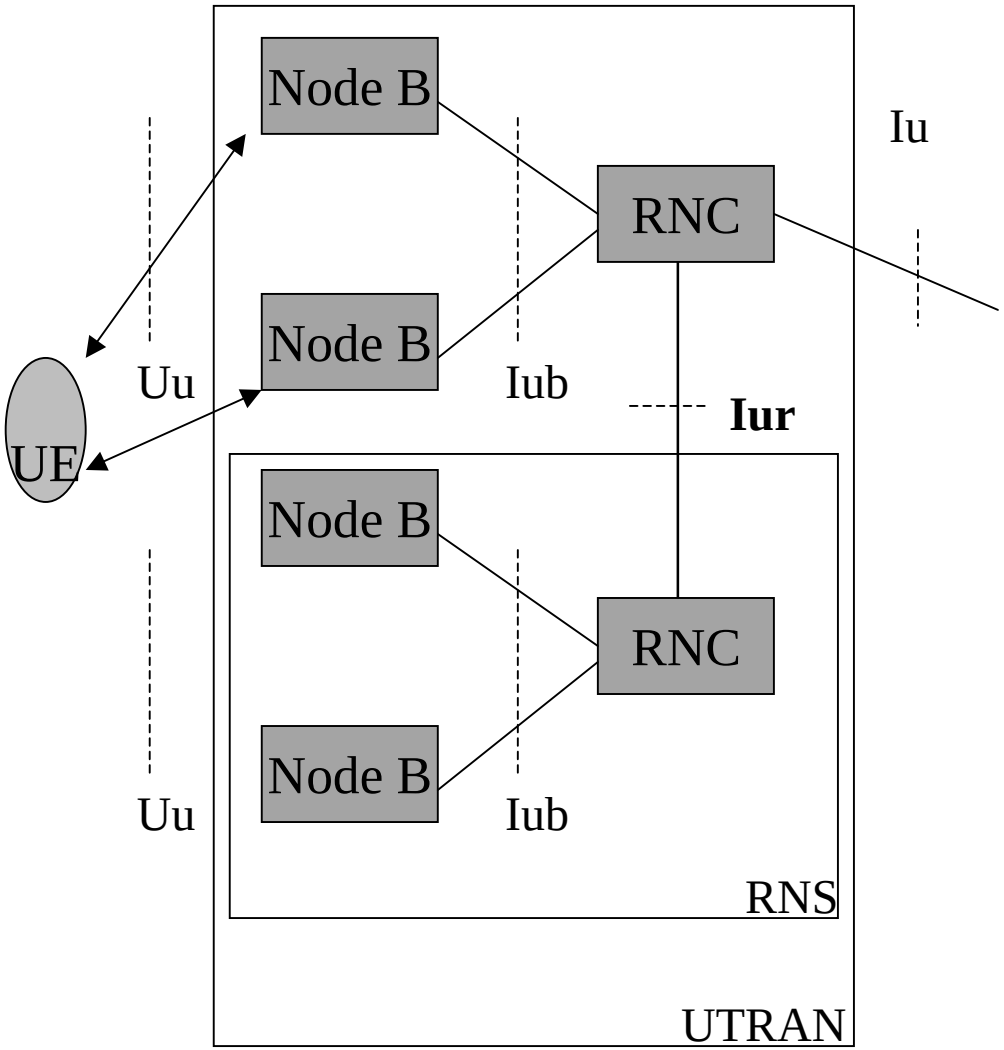
Macro Diversity



Softer Handover

- 1 BS
- 1 RNC

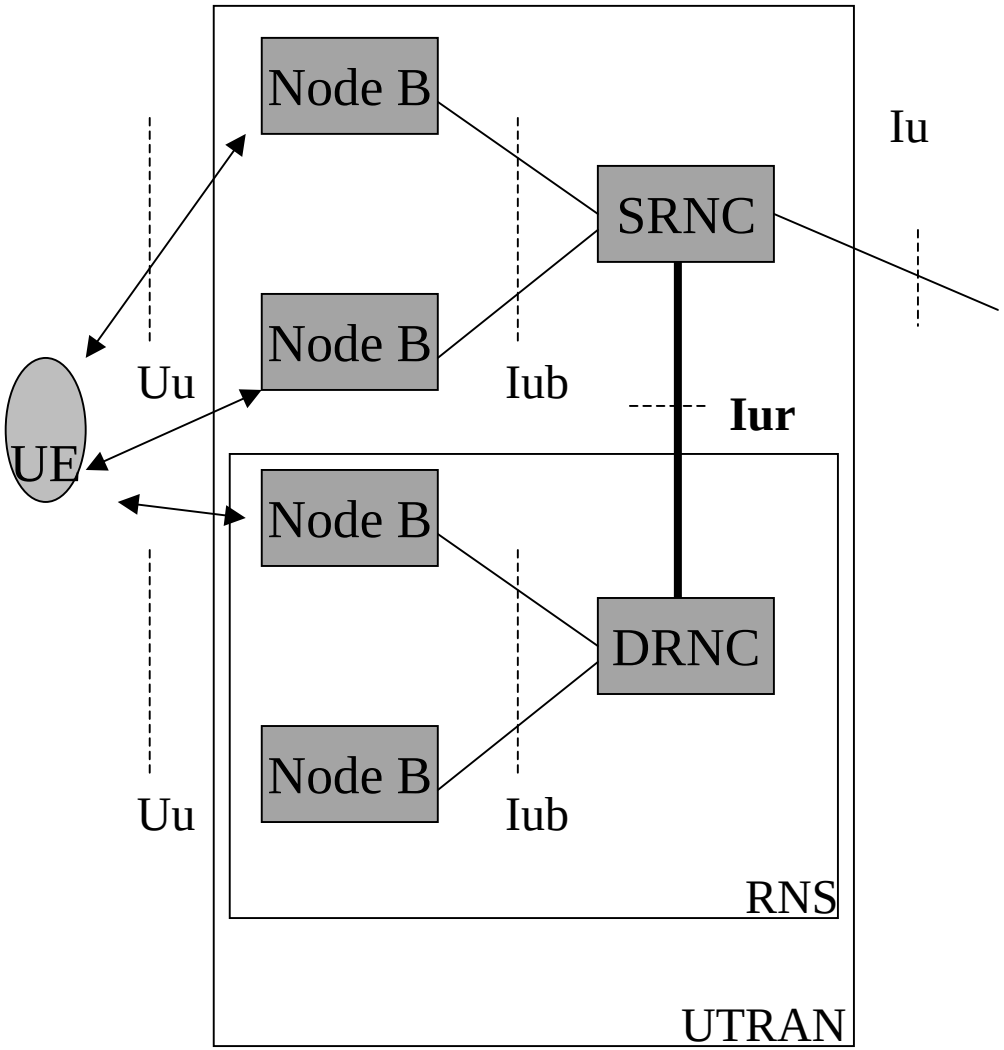
Macro Diversity



Soft Handover

- Number of BSs
- 1 RNC (MDC)

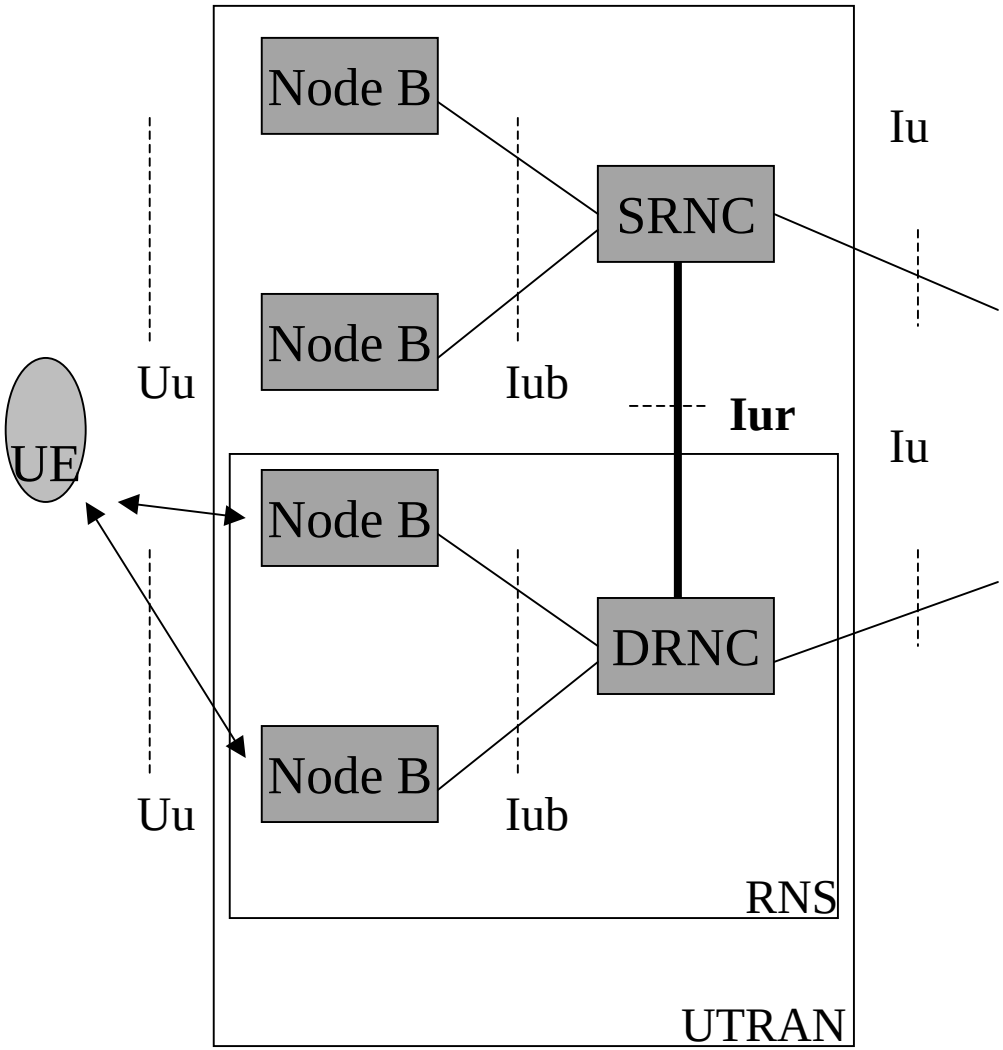
Macro Diversity



Soft Handover

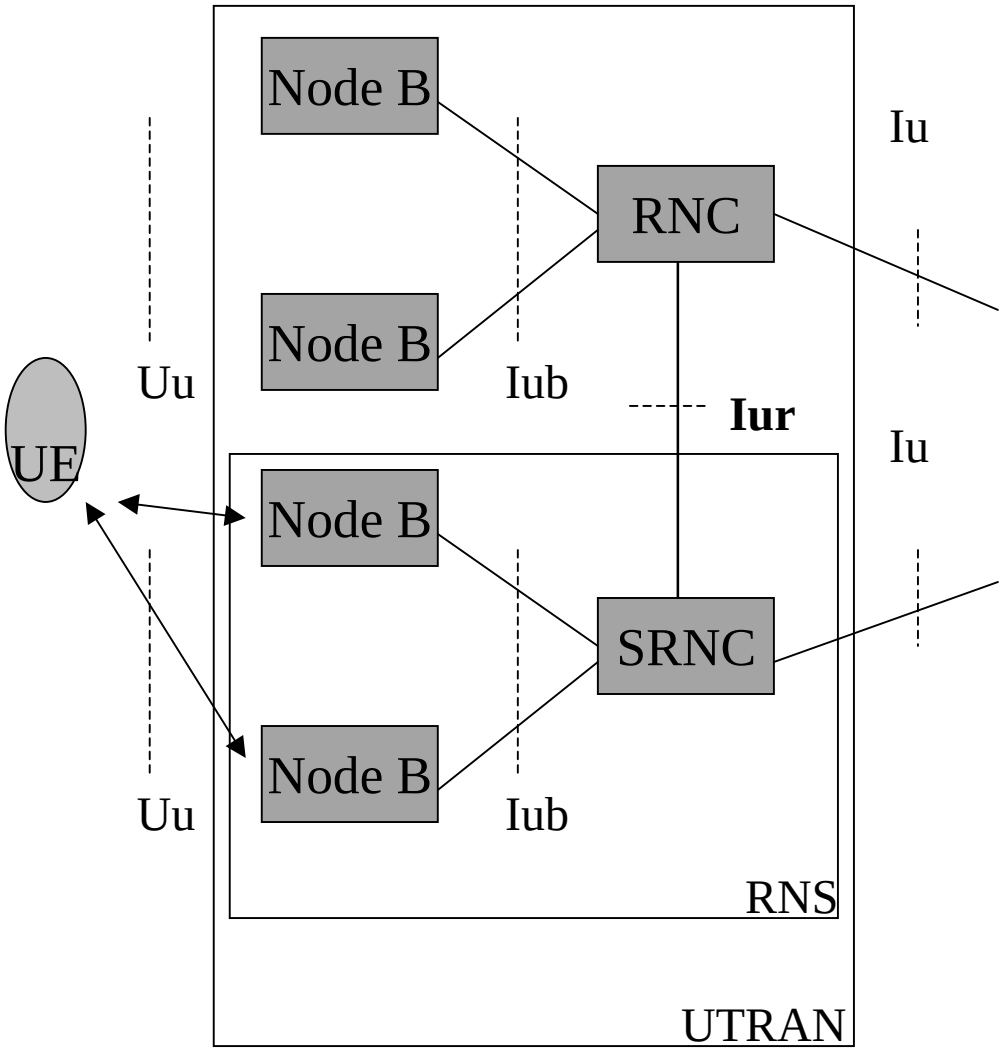
- Number of BSs
- 1 Serving RNC (MDC)
- Number of Drift RNC

Macro Diversity



SRNC Anchoring

Macro Diversity



SRNC Relocation

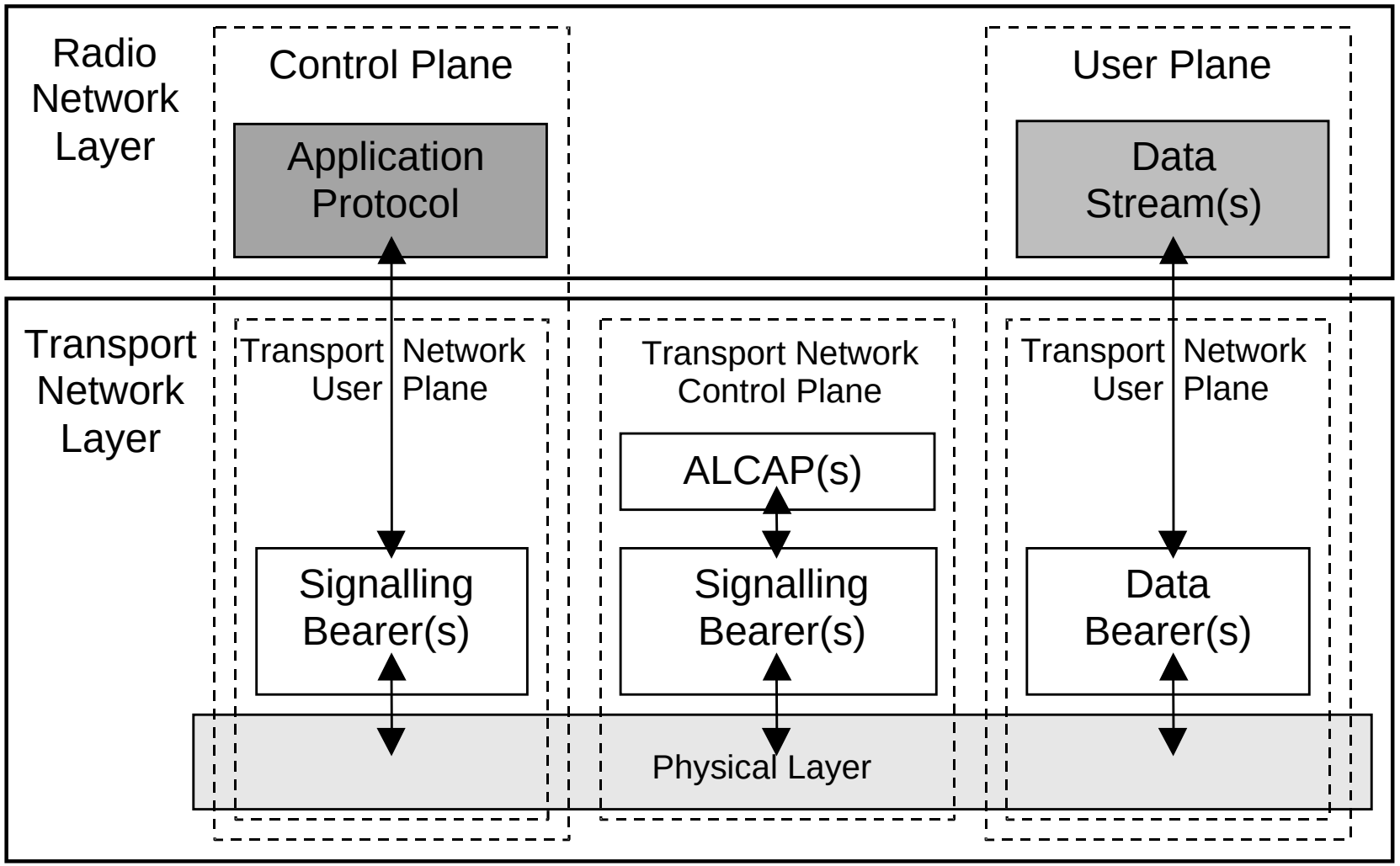
Node B

- Standardisation term (normally called as Base Station)
- Comparable to Base Tranceiver Station in GSM
- Responsible for Air Interface Layer 1
- Key Node B Functions:
    - Modulation and spreading
    - RF Processing
    - Inner-loop power control
    - Rate matching
    - Macro diversity combining/splitting inside Node B

Radio Network Controller (RNC)

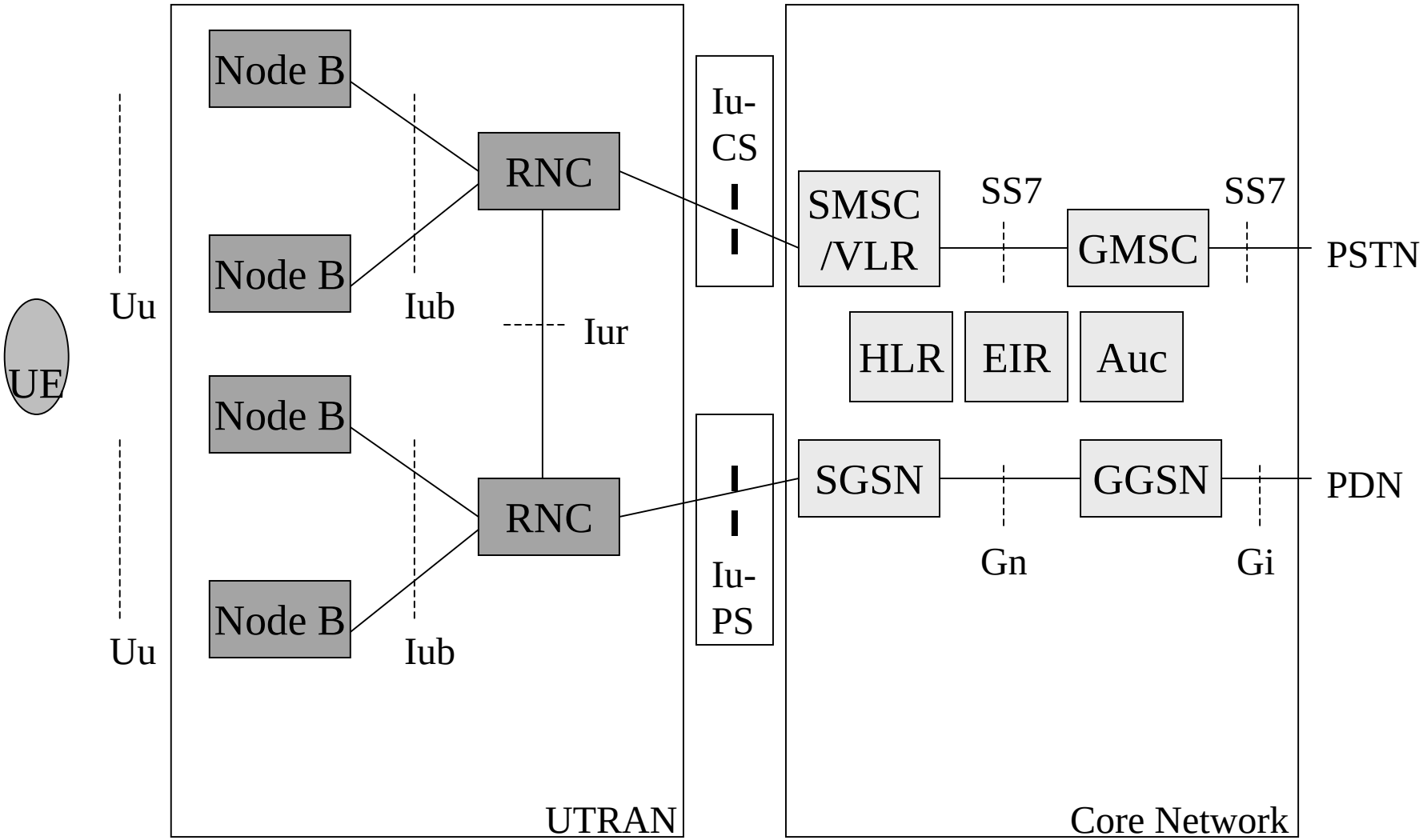
- Comparable to Base Station Controller in GSM
- Responsible for L2 processing of user data
- Responsible for Radio Resource Management
- Key RNC Functions:
    - Closed loop power control
    - Handover control
    - Admission control
    - Code allocation
    - Packet scheduling
    - Macro diversity combining/splitting over number of Node Bs

General Protocol model for UTRAN



Lähde: 3GPP TS25401-380

3GPP Release 99 Reference Architecture



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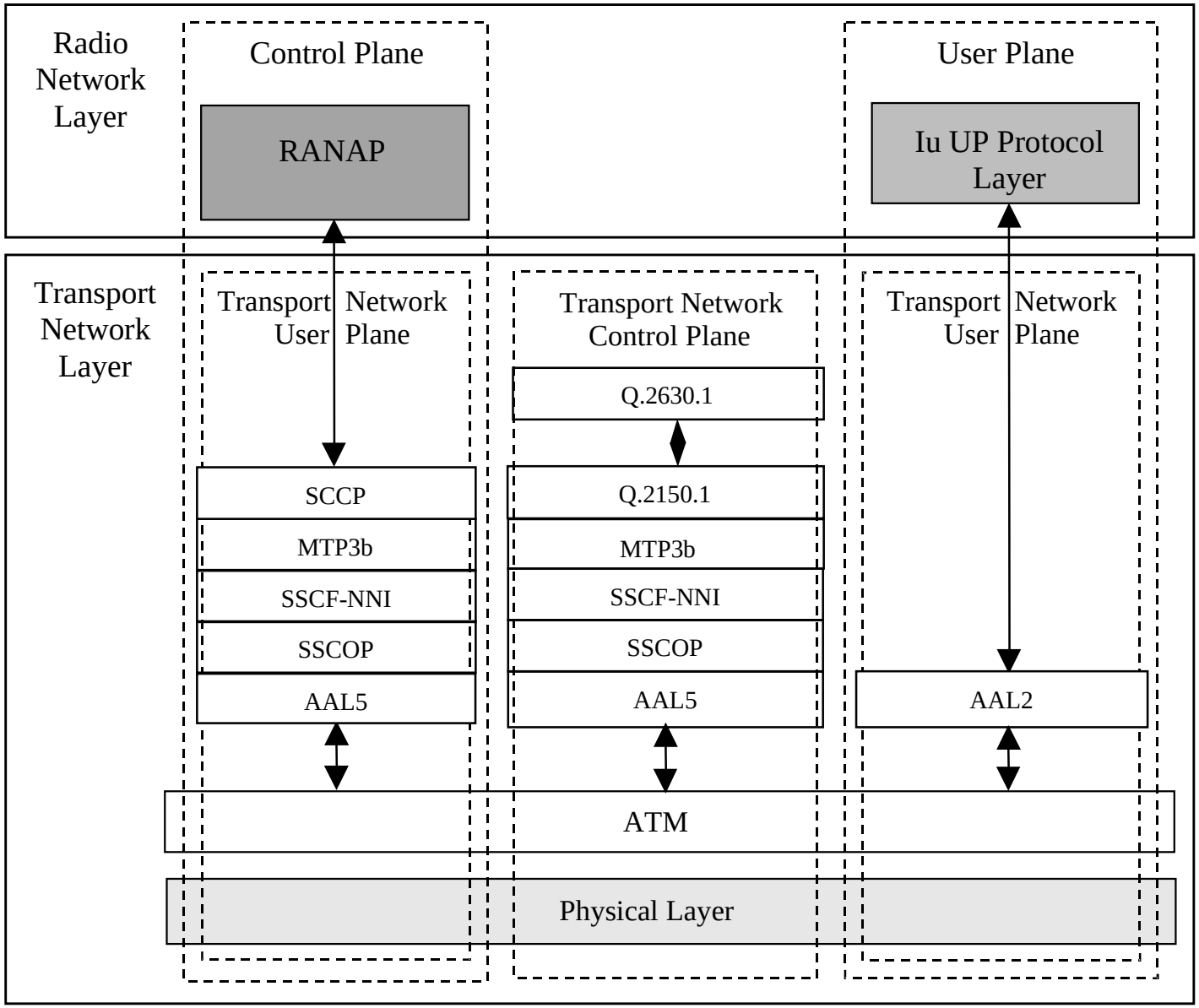
Radio Access Network Application Part (RANAP)

Key RANAP functions:

- Radio Access Bearer (between UE-CN)
  - RAB Set-UP
  - RAB Modification
  - Clearing RAB
- Iu Bearer Release
- SRNC Relocation
- Paging Commands

Lähde: 3GPP TS 25410-360

Iu-CS



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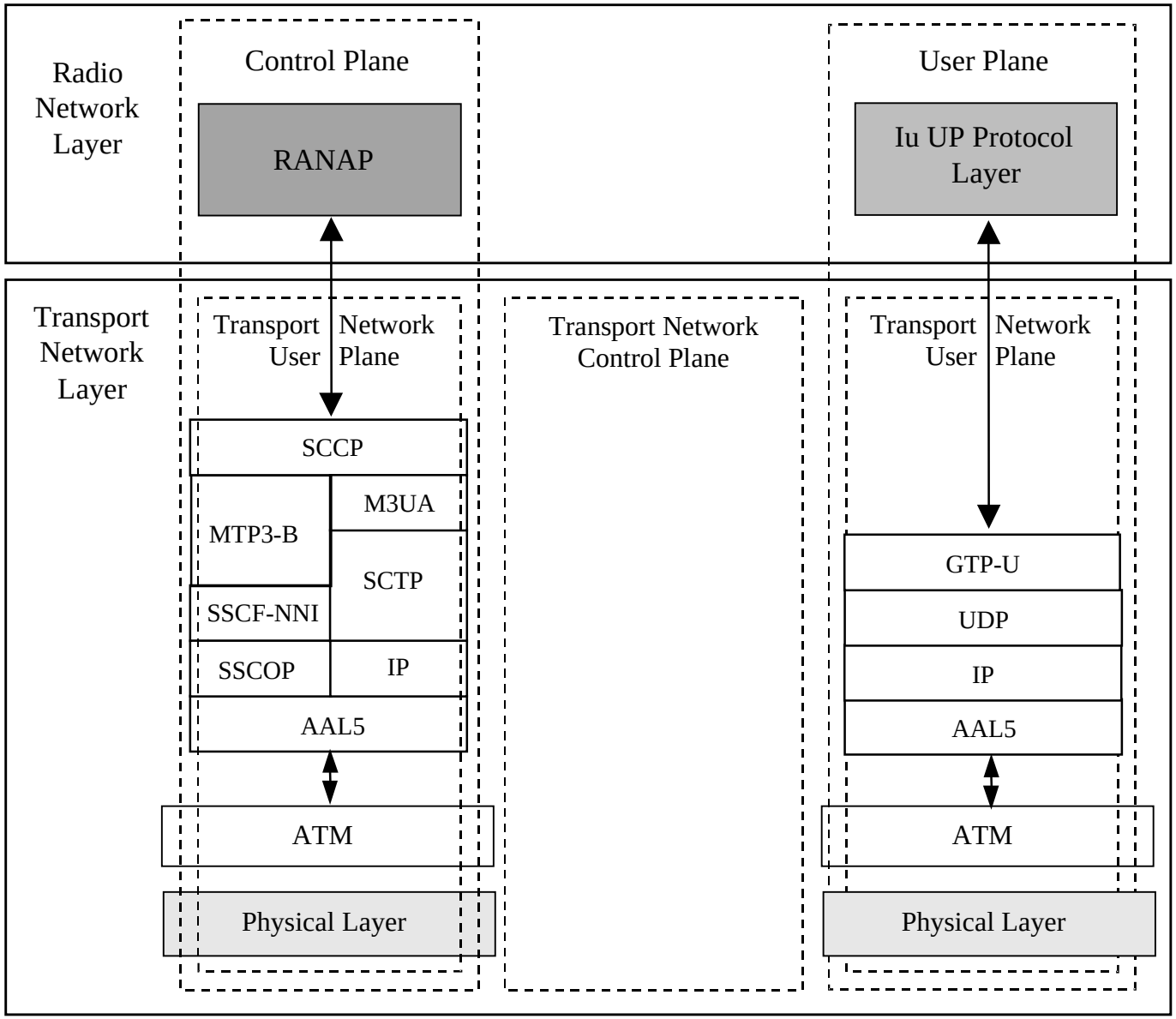
Lähde: 3GPP TS 25410-360

Iu-PS



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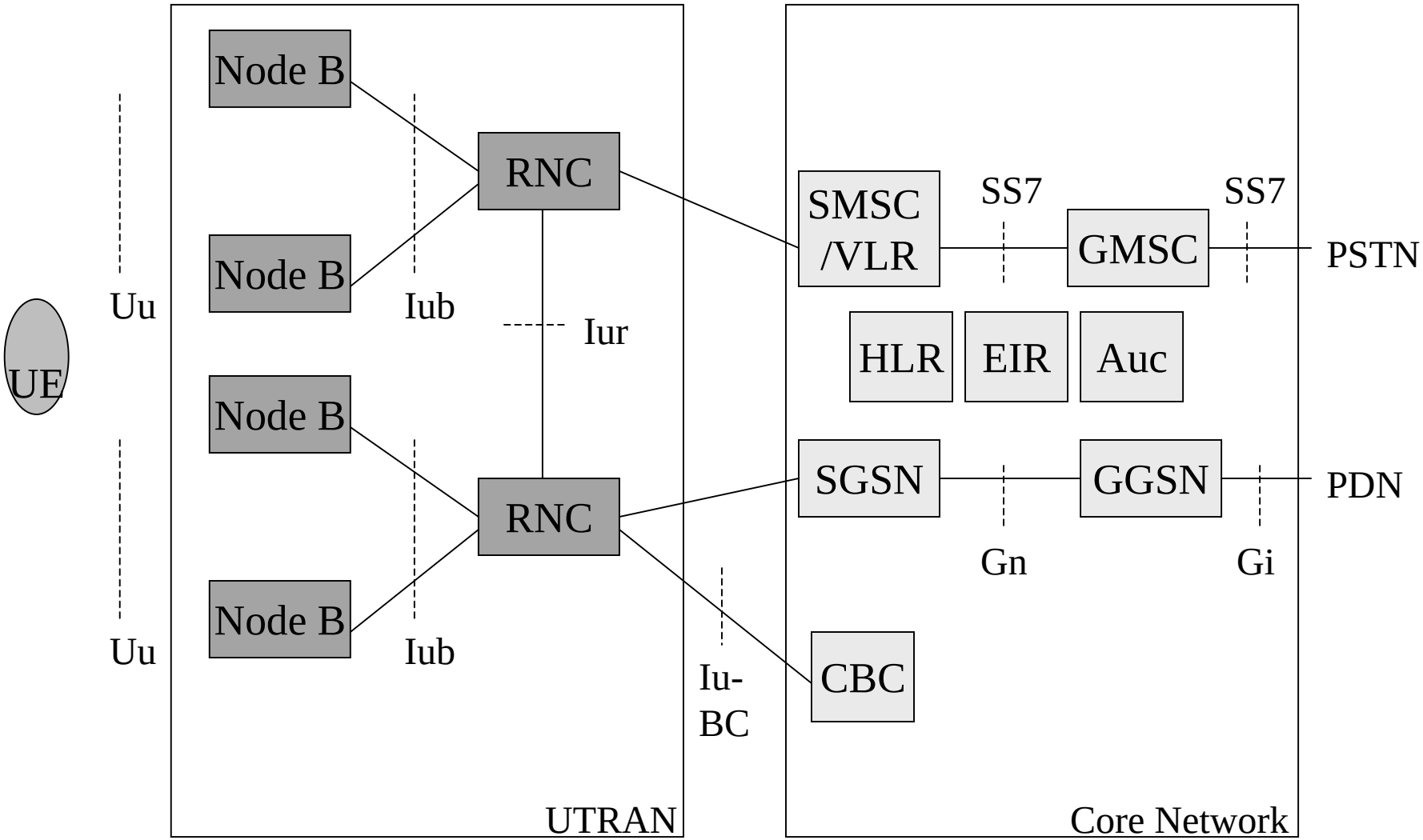
Lähde: 3GPP TS 25410-360

3GPP Release 99 Reference Architecture



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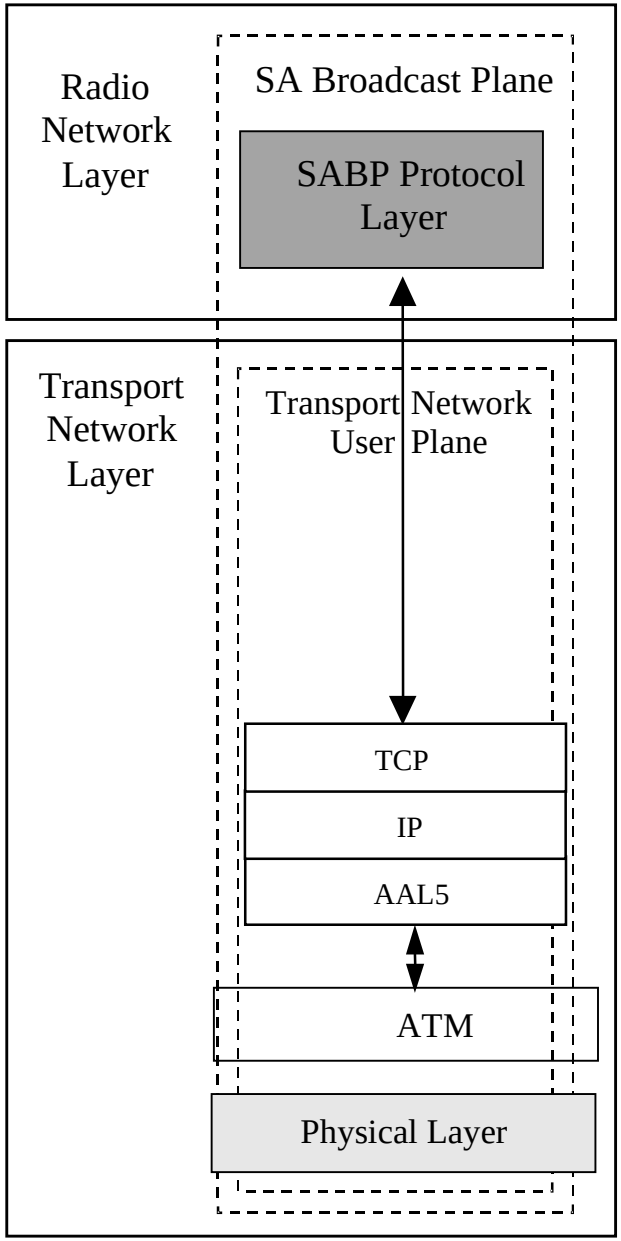
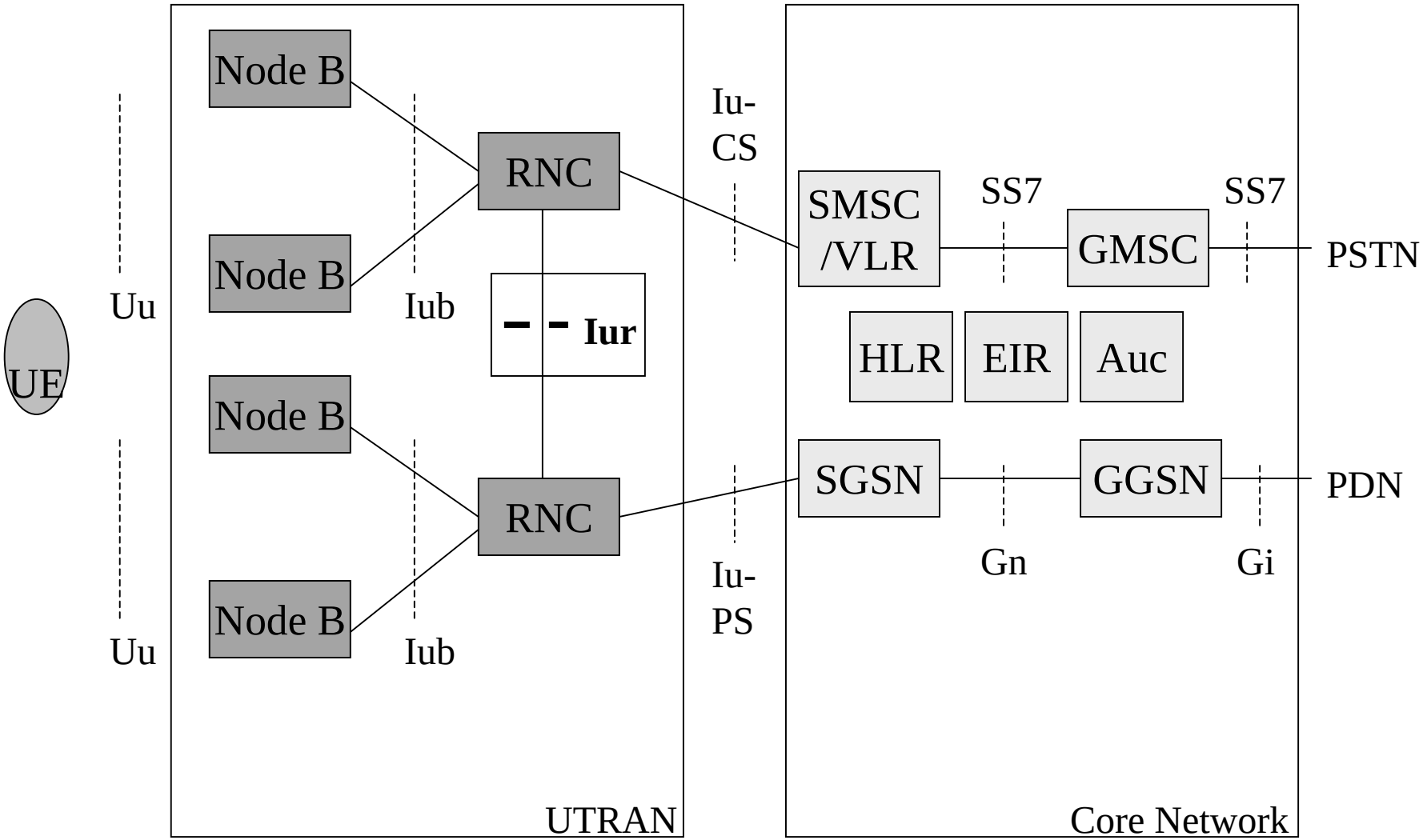
Iu-BC



- Between RNC and Common Broadcast Center CBC
- Service Area Broadcast Protocol (SABP)

Lähde: 3GPP TS 25410-360

3GPP Release 99 Reference Architecture



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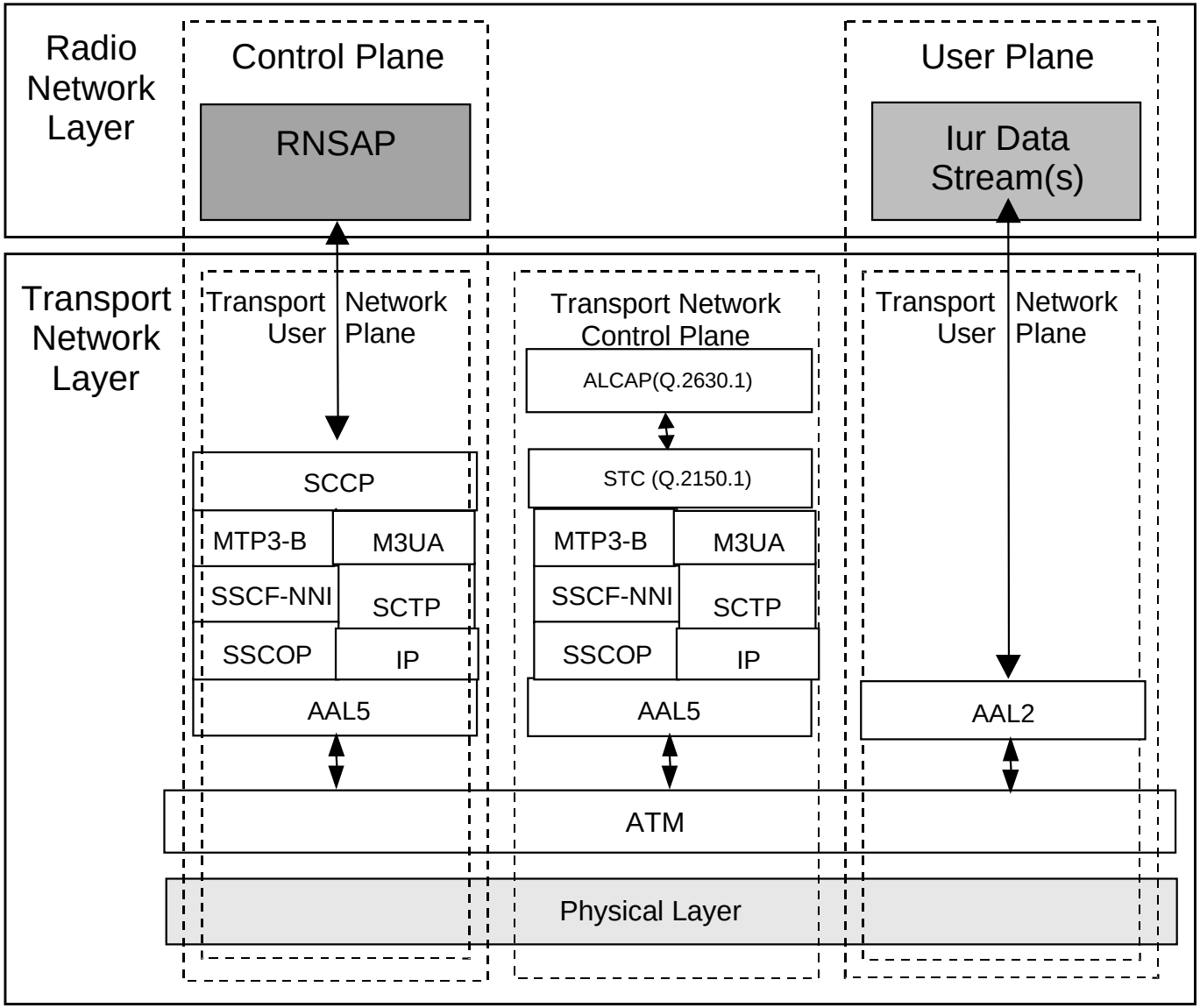
Radio Network Subsystem Application Part (RNSAP)

Key RNSAP Functions:

- Radio Link
  - Management (between SRNC and DRNC)
  - Reconfiguration (between SRNC and DRNC)
  - Supervision (reports from DRNC to SRNC)
- Common Control Channel (CCCH) Signalling Transfer
- Paging
- Relocation Execution

Iur



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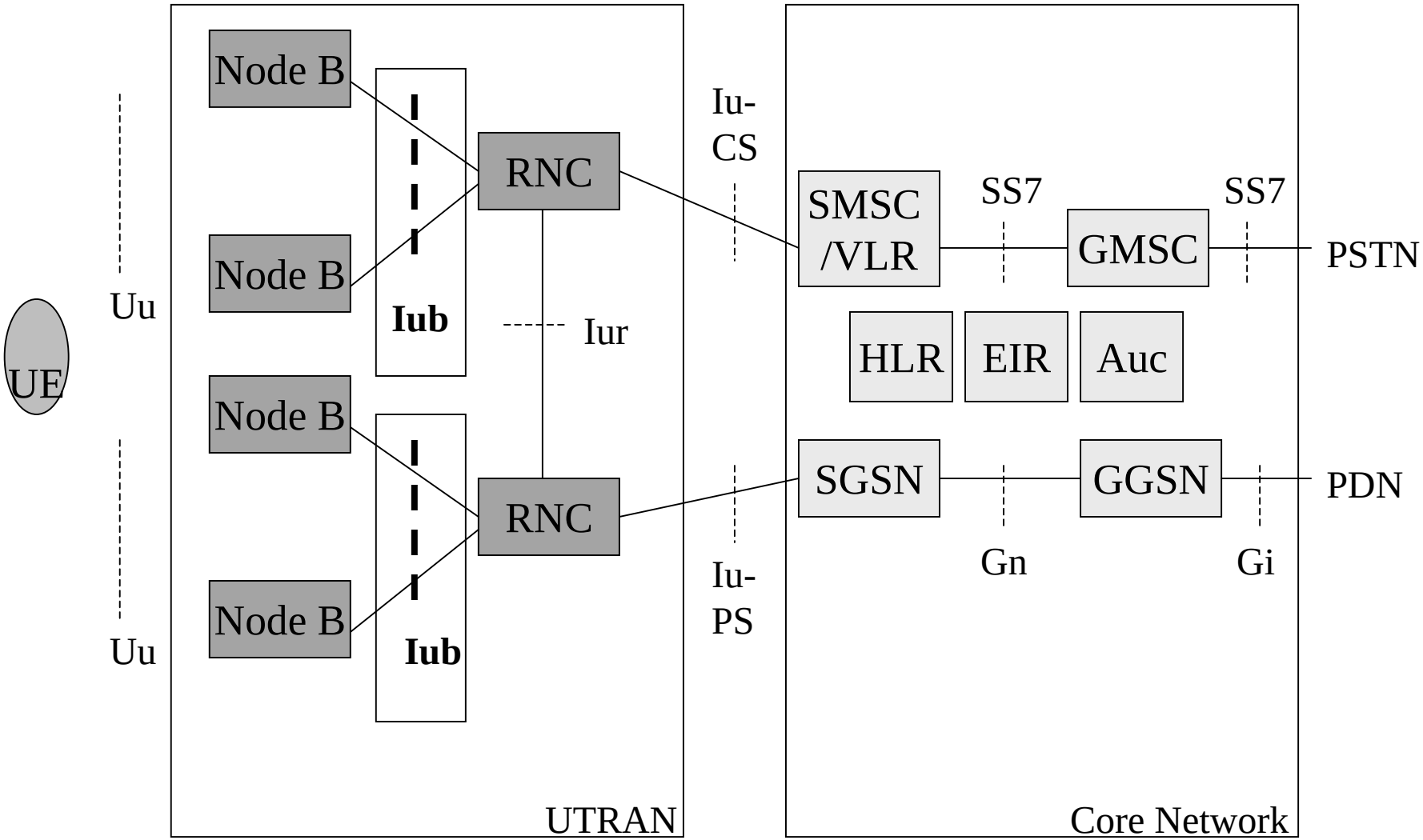
Lähde: 3GPP TS 25420-340

3GPP Release 99 Reference Architecture



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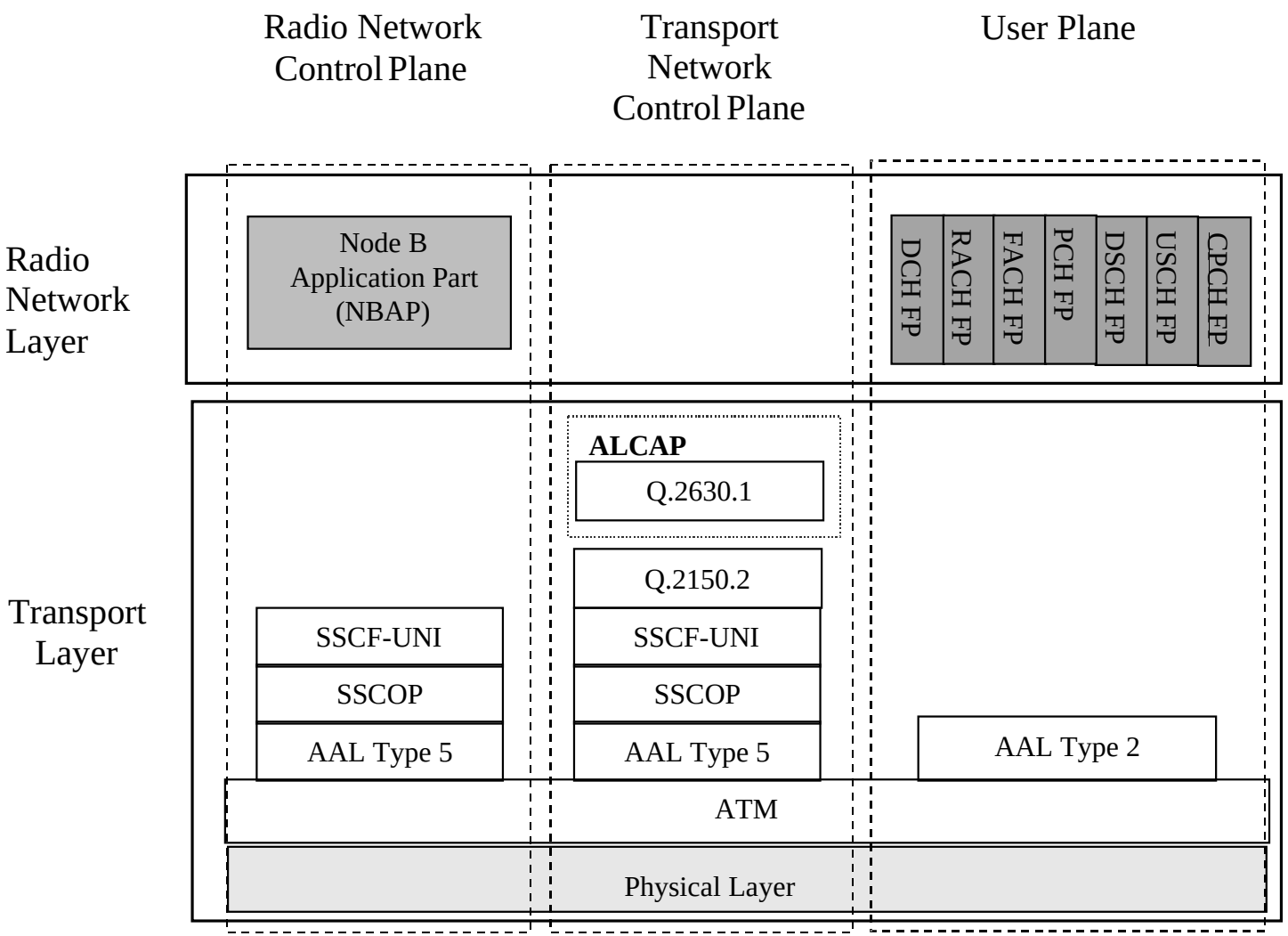
Node B Application Part (NBAP)

Key NBAP Functions:

- Cell Configuration Management
- Common Transport Channel Management
- System Information Management
- Configuration Verification/Alignment
- Measurements on Common Resources
- Radio Link Management & Supervision

Iub



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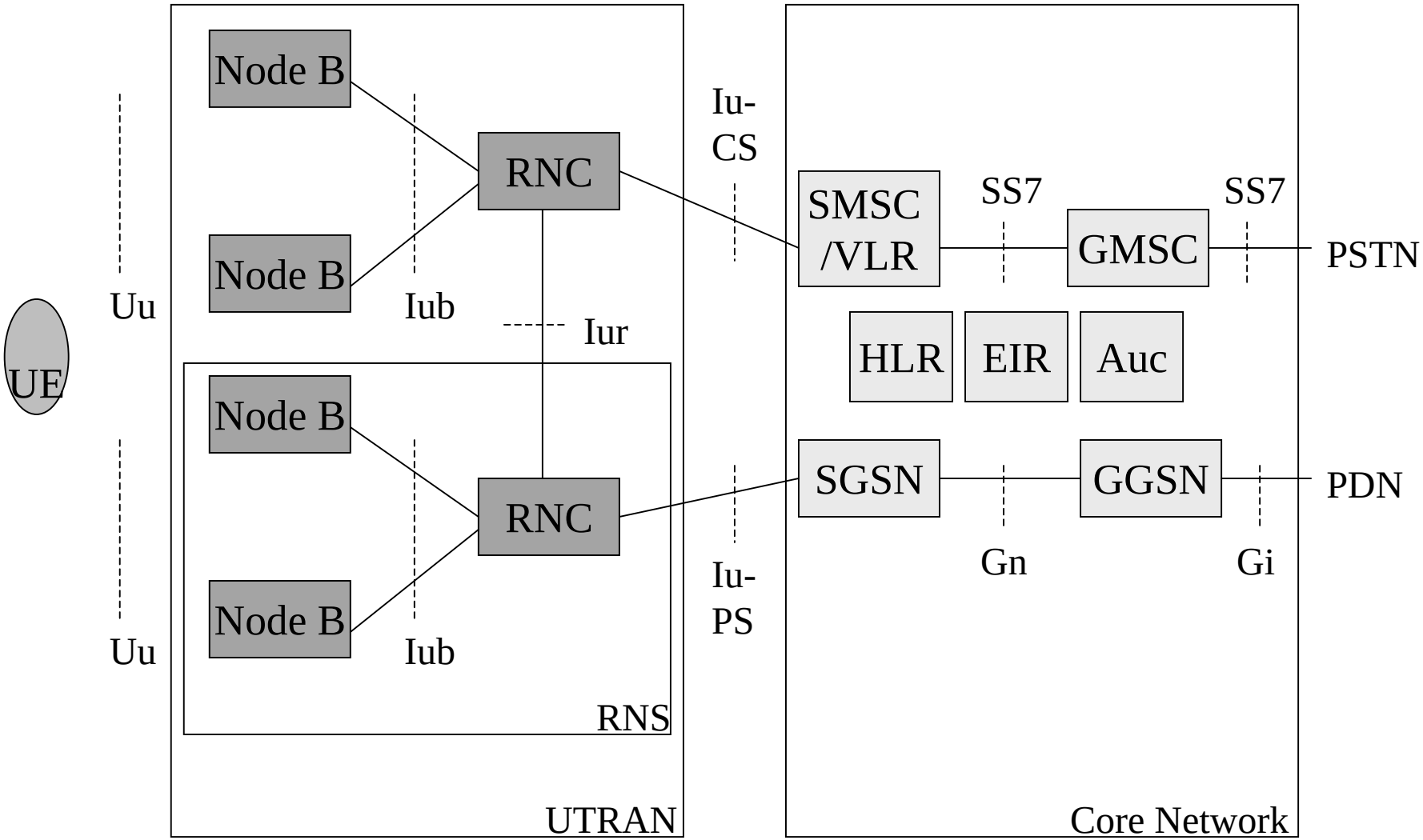
Lähde: 3GPP TS 25420-340

3GPP Release 99 Reference Architecture



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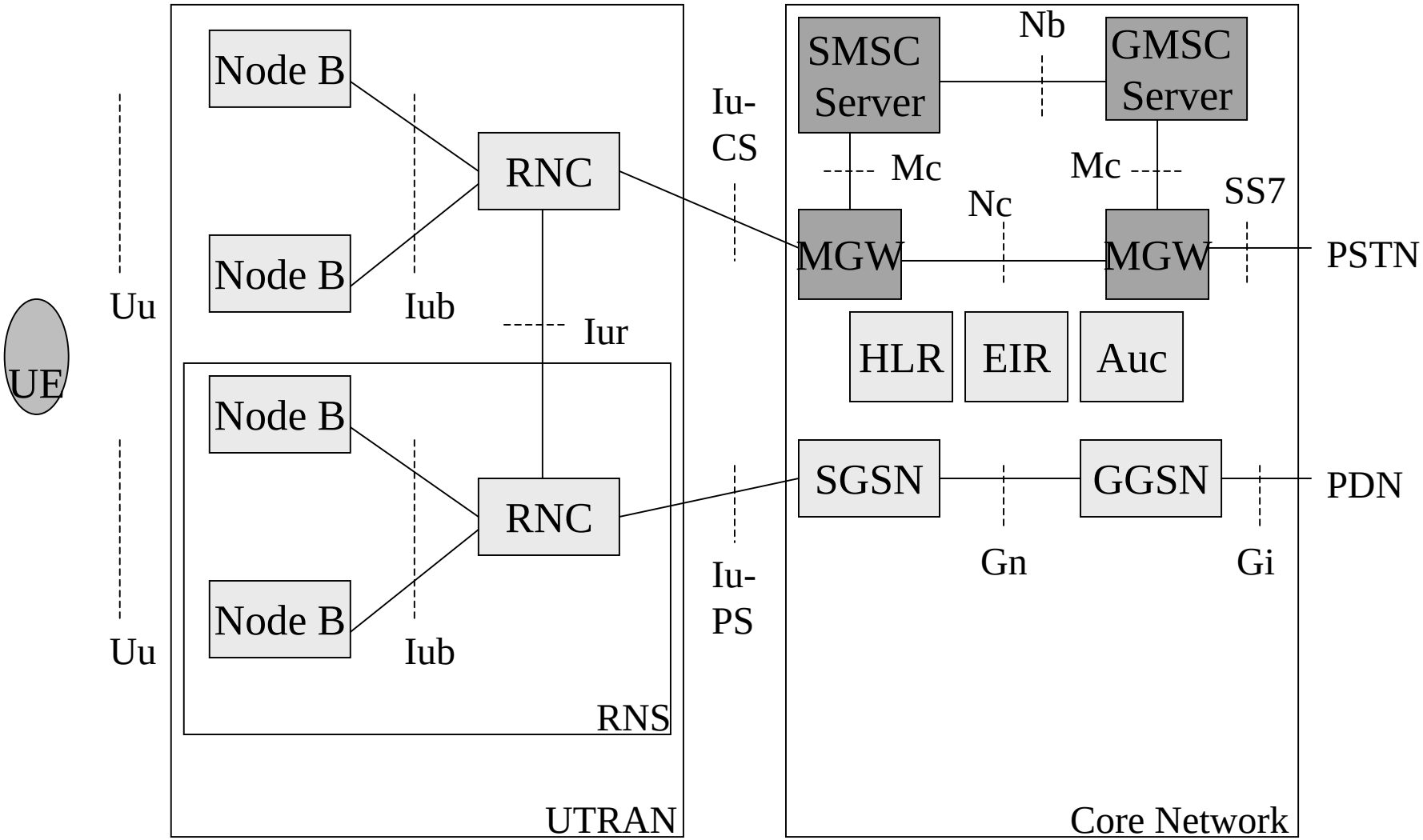
3GPP Release 4 Reference Architecture



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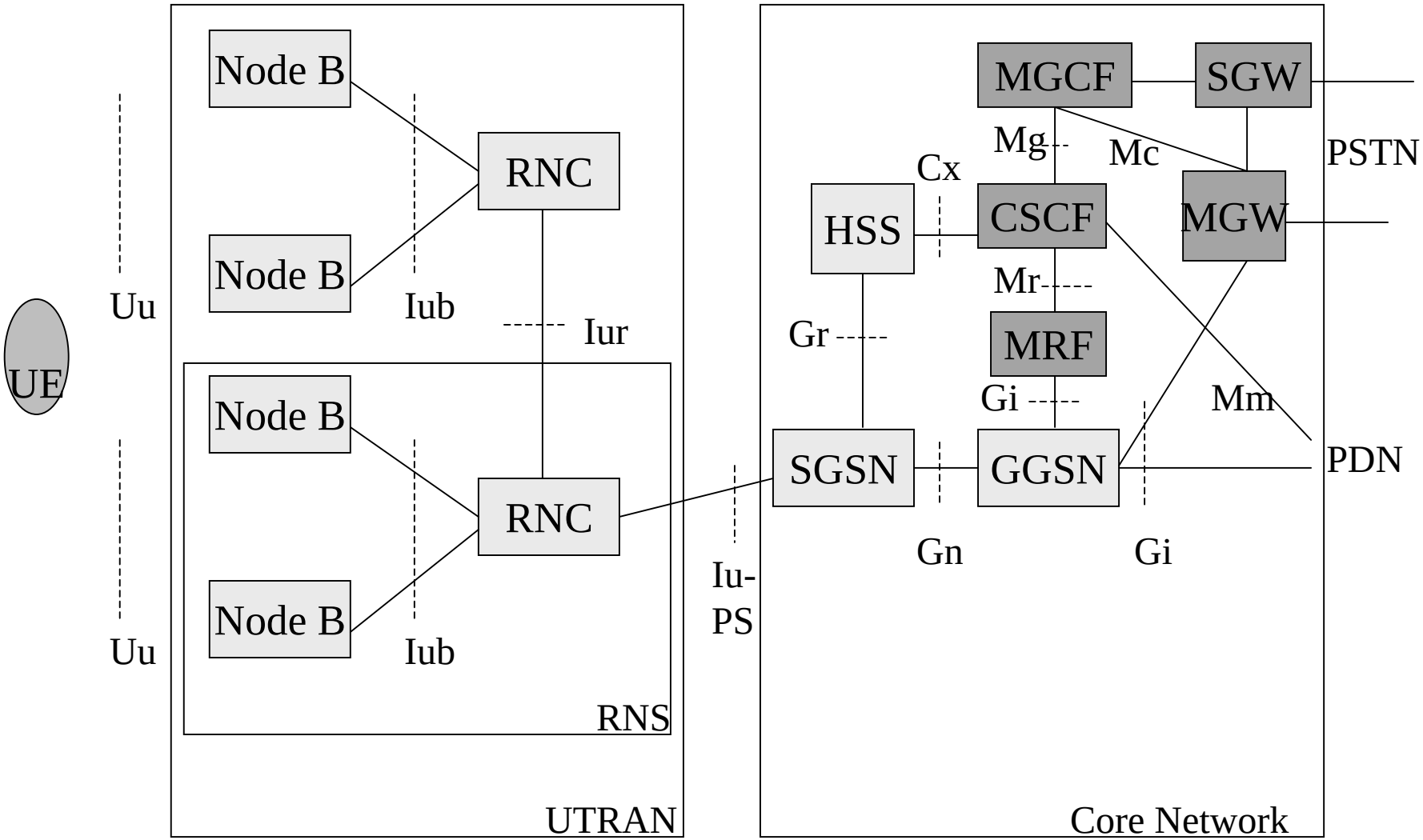
3GPP Release 5 Reference Architecture



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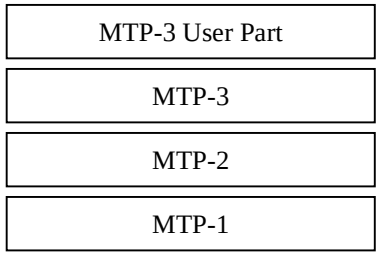
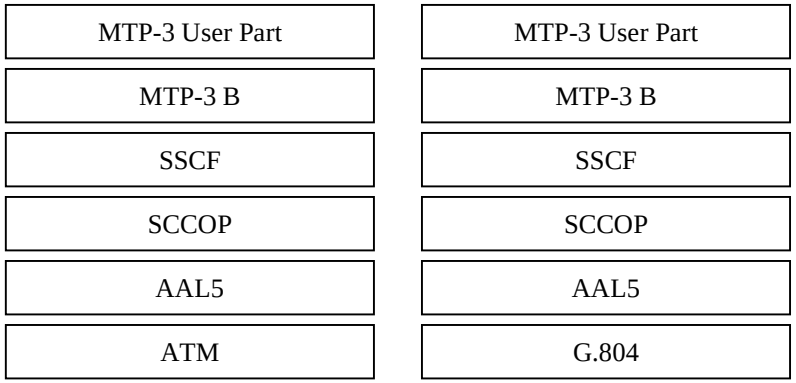
NOTE: Standardisation on-going!

SS7 signalling in UMTS Core

The original MTP stack. Commonly used in GSM Core interfaces.



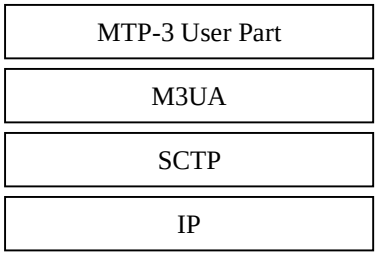
The ATM based SS7 stack provides Broadband SS7 architecture.



ATM over SDH

ATM over PDH

The IP based stack uses Stream Control Transmission Protocol (SCTP) to deliver SS7 signalling over IP networks.



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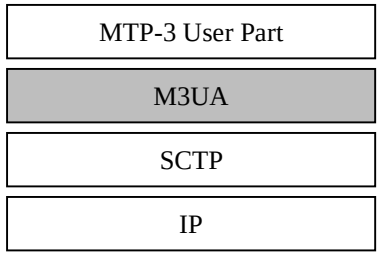
Lähde: 3GPP TS 25420-340

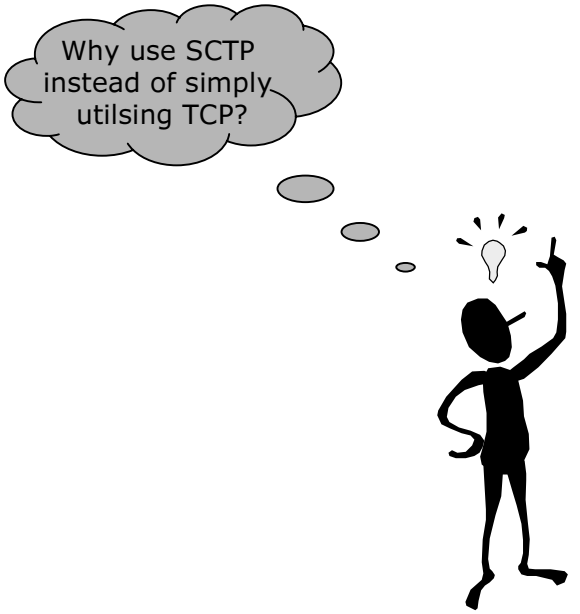
MTP3 User Adaptation Layer (M3UA)

- M3UA is an User adaptation sublayer that provides functions, required by signaling application protocols.
- IETF is currently standardising five adaptation sublayers: M2PA, M2UA, M3UA, SUA, and IUA.

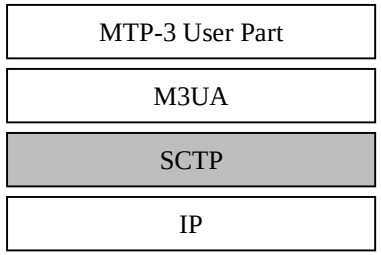
Note that each protocol can be implemented separately from other protocols, e.g., M3UA do not require services from M2UA!



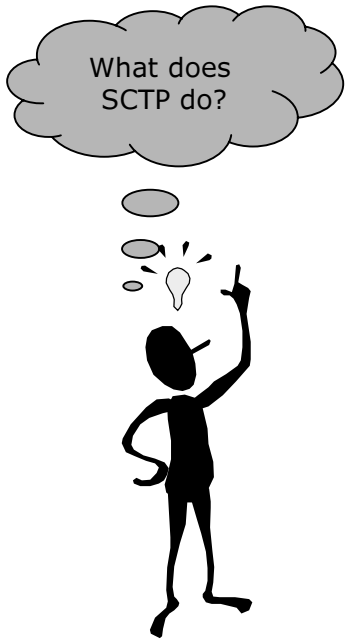
Stream Control Transmission Protocol (SCTP)



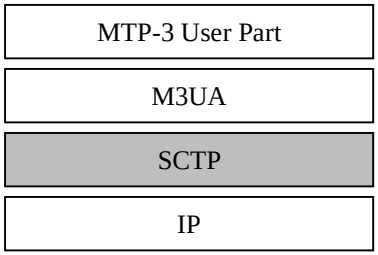
1. Although, the TCP provides reliable delivery of data it often adds unnecessary signalling and thus causes unwanted delay of service.
2. TCP applications have an inconvenience requirement to manage and mark the sequence numbers of each packet.
3. The limited scope of TCP sockets does not support the data transfer capability using multi-homed hosts.
4. Security of TCP is limited. For example, the TCP is relatively vulnerable to denial of service attacks, such as SYN attacks.



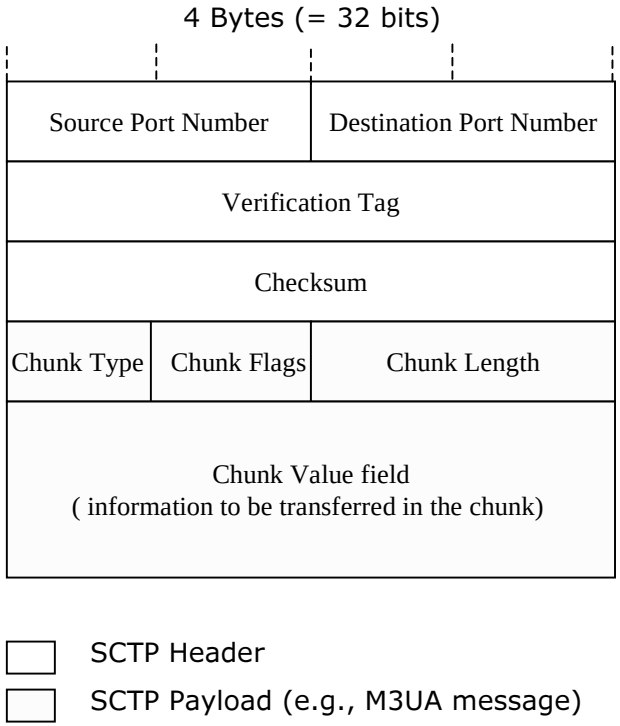
Stream Control Transmission Protocol (SCTP)

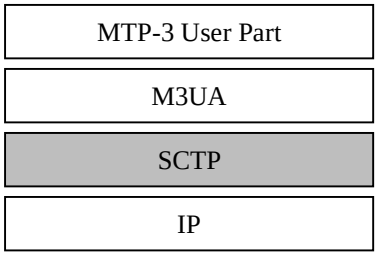


1. Acknowledged, error-free and non-duplicated packet-oriented delivery of signalling messages.
2. In sequence delivery of user messages within multiple streams, with an option for order-of-arrival delivery of individual messages.
3. Optionally, multiplexing multiple user messages into a single SCTP datagram.
4. Network level fault tolerance by supporting multi-homing.
5. Advanced congestion mechanisms for resistance to flooding and masquarade attacks.



Stream Control Transmission Protocol (SCTP)





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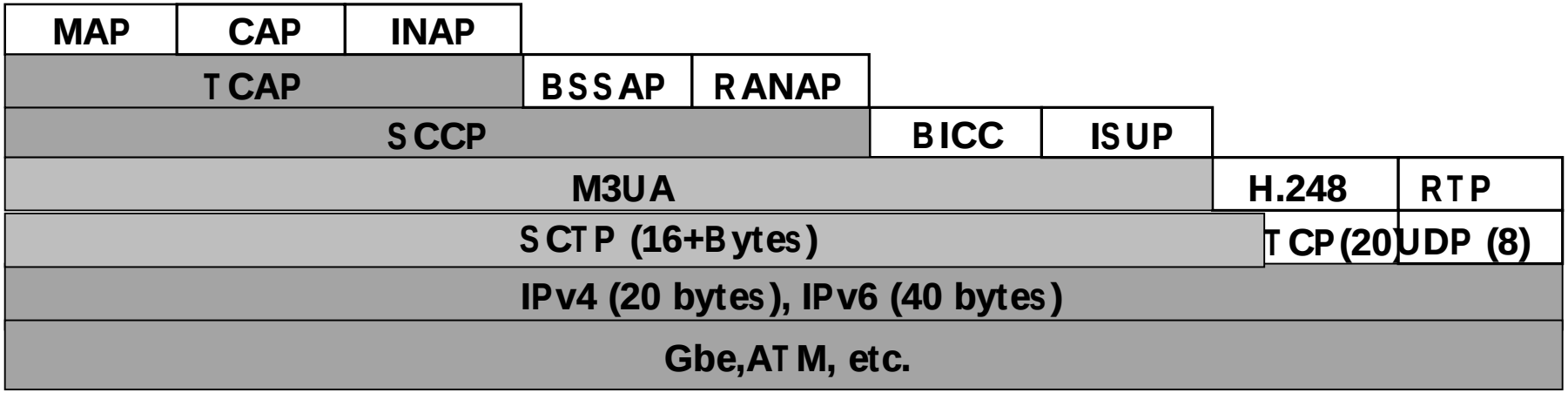
MAP
CAP
INAP
TCAP
BSSAP
RANAP
SCCP
BICC
ISUP
M3UA
H.248
RTP
SCTP (16+Bytes)
TCP (20)
UDP (8)
IPv4 (20 bytes), IPv6 (40 bytes)
Gbe,ATM, etc.