LTE System Architecture Evolution

T-110.5120 Next Generation Wireless Networks

Lecture 10.11.2010

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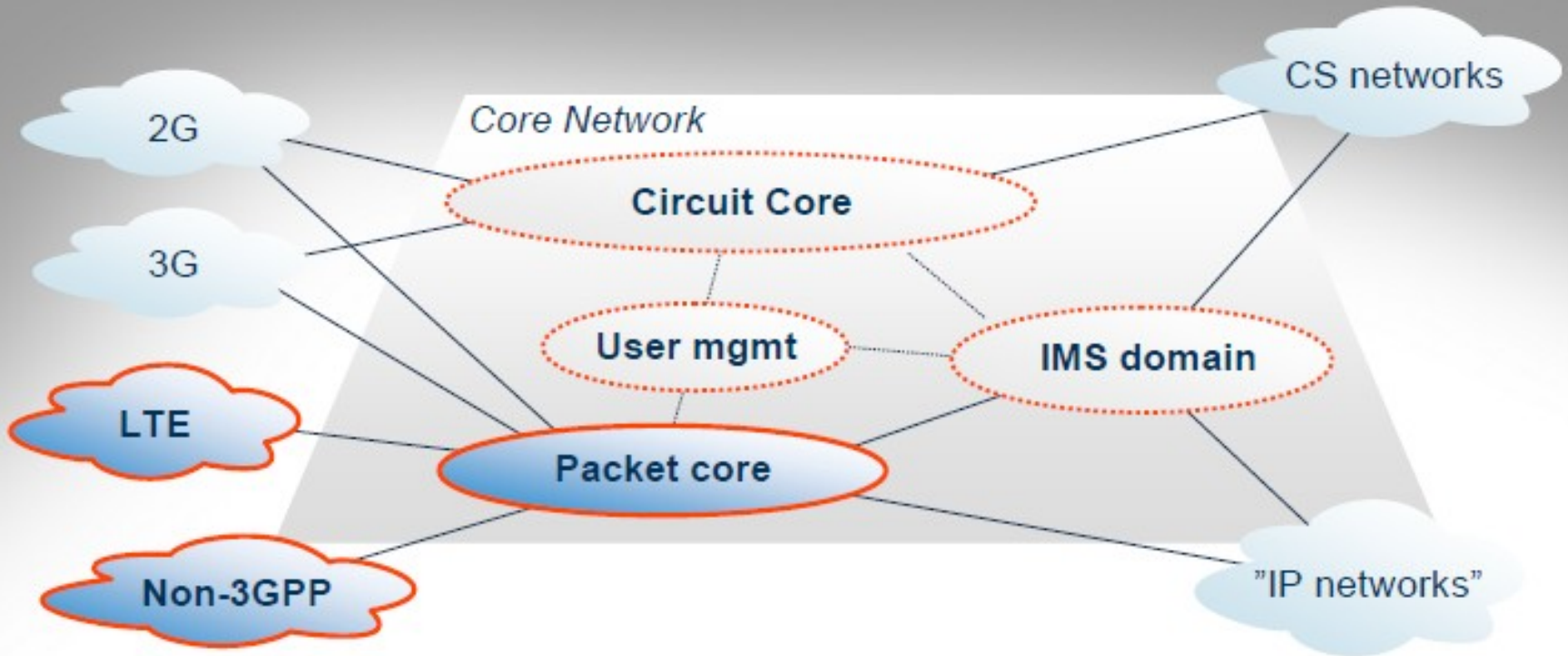
Motivation for 3GPP Release 8 - The LTE Release

- Need to ensure the continuity of competitiveness of the 3G system for the future
- User demand for higher data rates and quality of service
- Packet Switch optimized system
- Continued demand for cost reduction (CAPEX and OPEX)
- Low complexity
- Avoid unnecessary fragmentation of technologies for paired (FDD) and unpaired (TDD) band operation
  - OFDM; FFT & IFFT

Source: www.3gpp.org/LTE

What is LTE and SAE?



Teminology

LTE = Long Term Evolution (also known as eUTRAN)
SAE = System Architecture Evolution
(3GPP technical study item defining EPC)
EPC = Evolved Packet Core
EPS = Evolved Packet System incl EPC, LTE and terminals

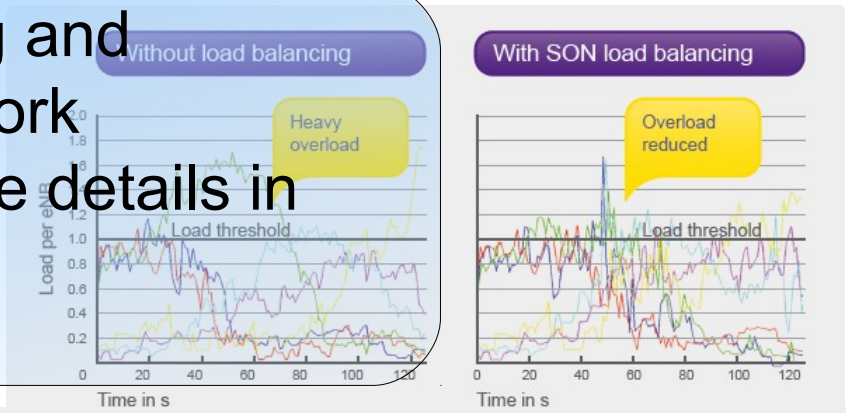
High level requirements

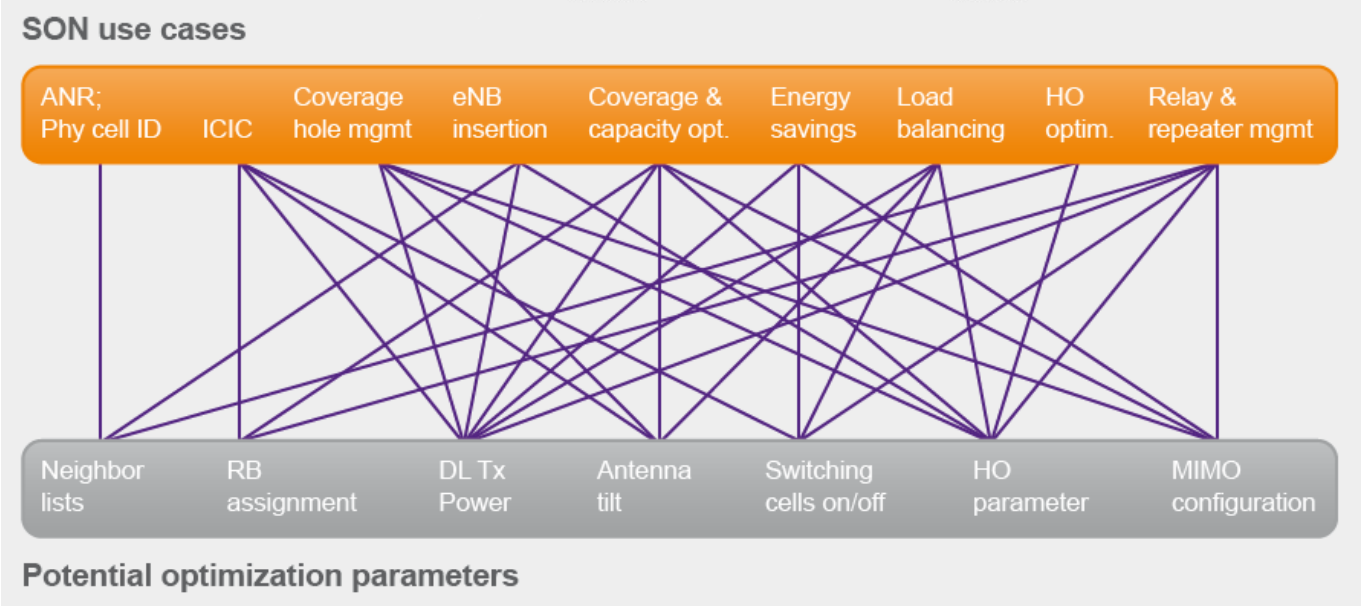
- Increased peak data rates: 100Mbps downlink and 50Mbps uplink.
- Reduction of RAN latency to 10ms
- Improved spectrum efficiency (two to four times compared with HSPA Release 6)
- Cost-effective migration from Release 6 Universal Terrestrial Radio Access (UTRA) radio interface and architecture
- Improved broadcasting
- IP-optimized (focus on services in the packet switched domain)
- Scalable bandwidth of 20MHz, 15MHz, 10MHz, 5MHz, 3MHz and 1.4MHz
- Support for both paired and unpaired spectrum
- Support for inter-working with existing 3G systems and non-3GPP specified systems

Source: www.3gpp.org/LTE

Self-organizing networks (SON)

- Automated configuring, operating and optimizing of cellular access network
- Introduced in Release 8, but more details in future releases
- Interoperability?





Source: Nokia Siemens Networks

LTE-Release 8 User Equipment Categories

Category		1	2	3	4	5
Peak rate Mbps	DL	10	50	100	150	300
	UL	5	25	50	50	75
[illegible]						
						QPSK, 16QAM, 64QAM
						Mandatory

"The link performance of current cellular systems such as LTE is already quite close to the Shannon limit."

http://www.ericsson.com/res/thecompany/docs/journal_conference_papers/wireless_access/VTC08F_jading.pdf

Source: www.3gpp.org/LTE

LTE Release 8 Key Features

- High spectral efficiency
  - OFDM in Downlink, MIMO
  - DFTS-OFDM("Single-Carrier FDMA") in Uplink, Low PAPR
- Very low latency
  - Short setup time & Short transfer delay
  - Short HO latency and interruption time; Short TTI
- Support of variable bandwidth
  - 1.4, 3, 5, 10, 15 and 20 MHz
- Simple Architecture
- Inter-working with other systems, e.g. cdma2000
- FDD and TDD within a single radio access technology
- Support of Self-Organising Network (SON) operation

Source: www.3gpp.org/LTE

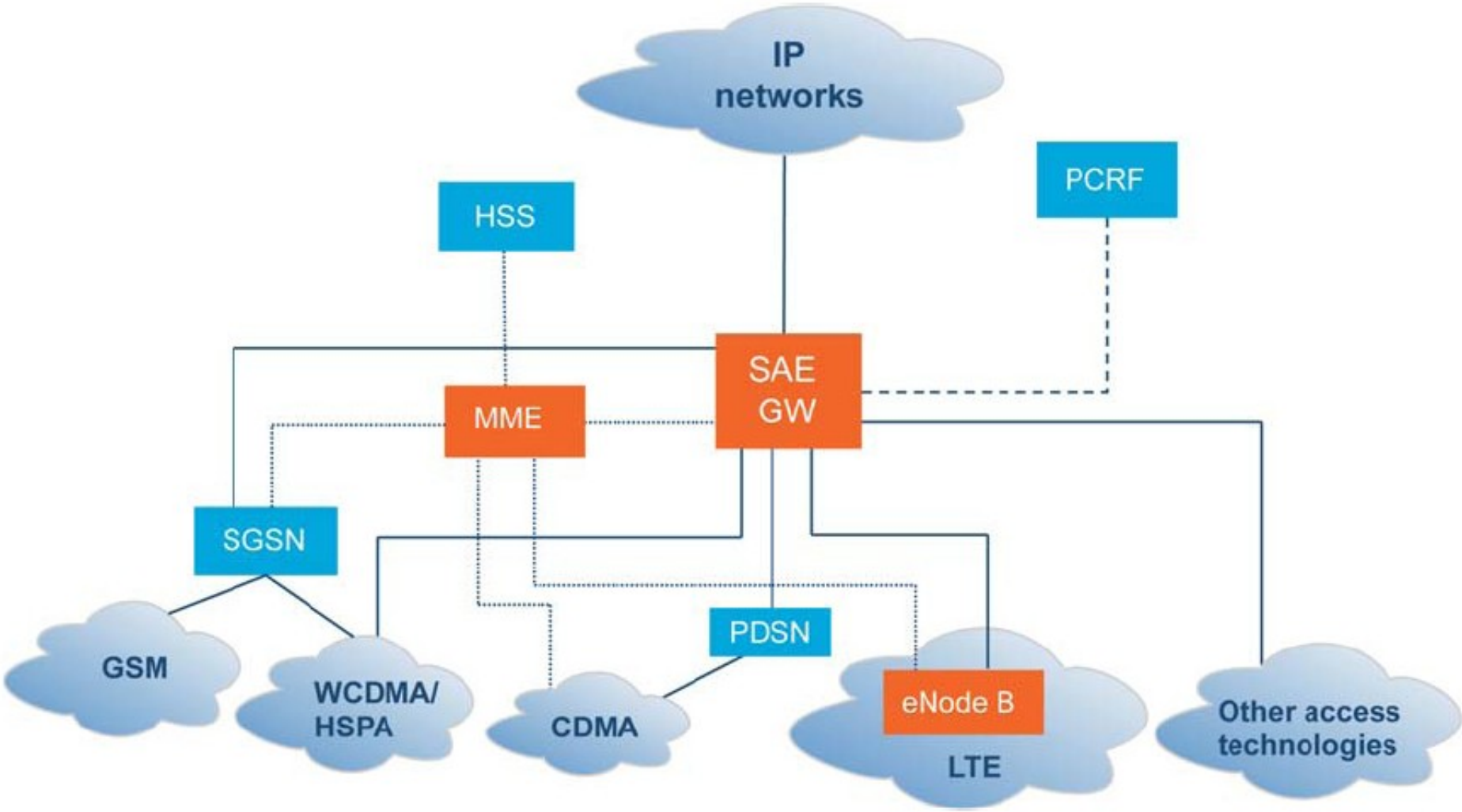
LTE in the news

- 14 December 2009: TeliaSonera launches commercial LTE in Stockholm and Oslo
- 26 June 2010: TeliaSonera opens LTE network in Malmo & Gothenburg
- 22 September 2010: MetroPCS launches country's first LTE network, world's first LTE handset
- 22 October 2010: Deutsche Telekom first to deploy LTE in digital dividend spectrum – launch during 2010

Wireless access evolution

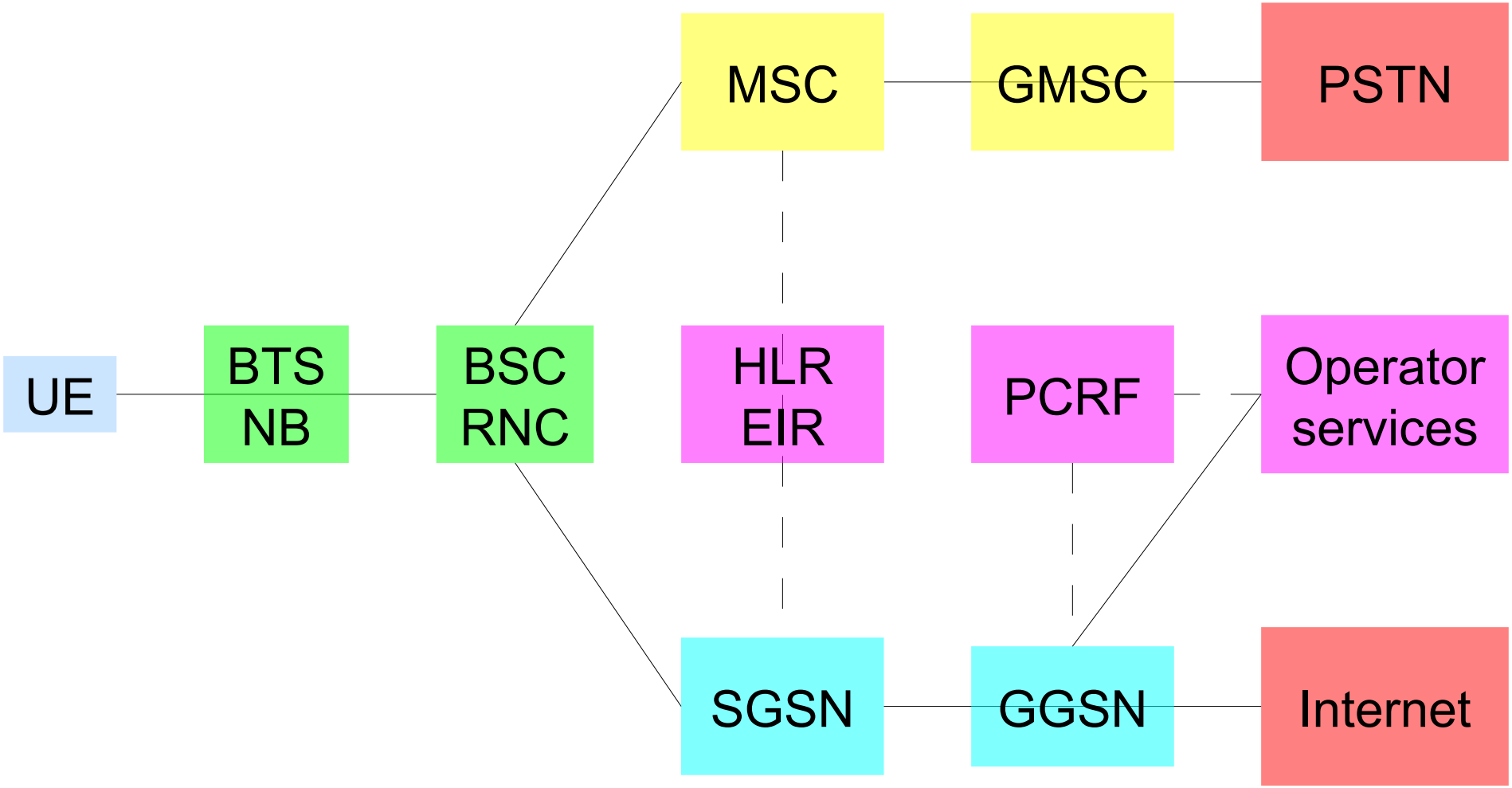
2G / 3G / 4G cellular networks

LTE interworking with 2G/3G accesses

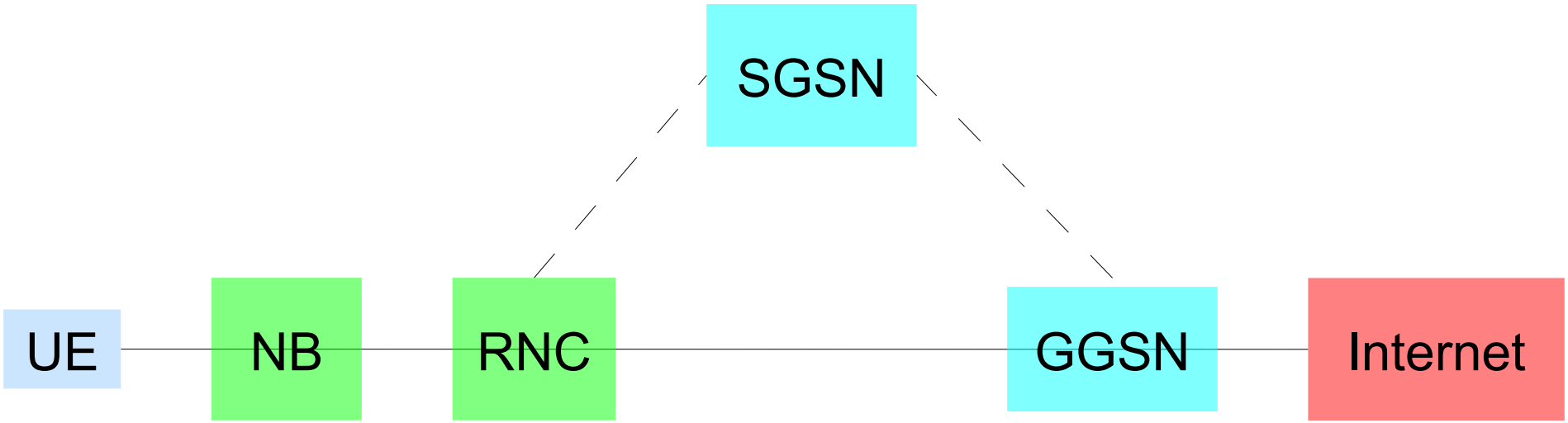


Source: Ericsson, ”LTE – an introduction”, White paper, 2009

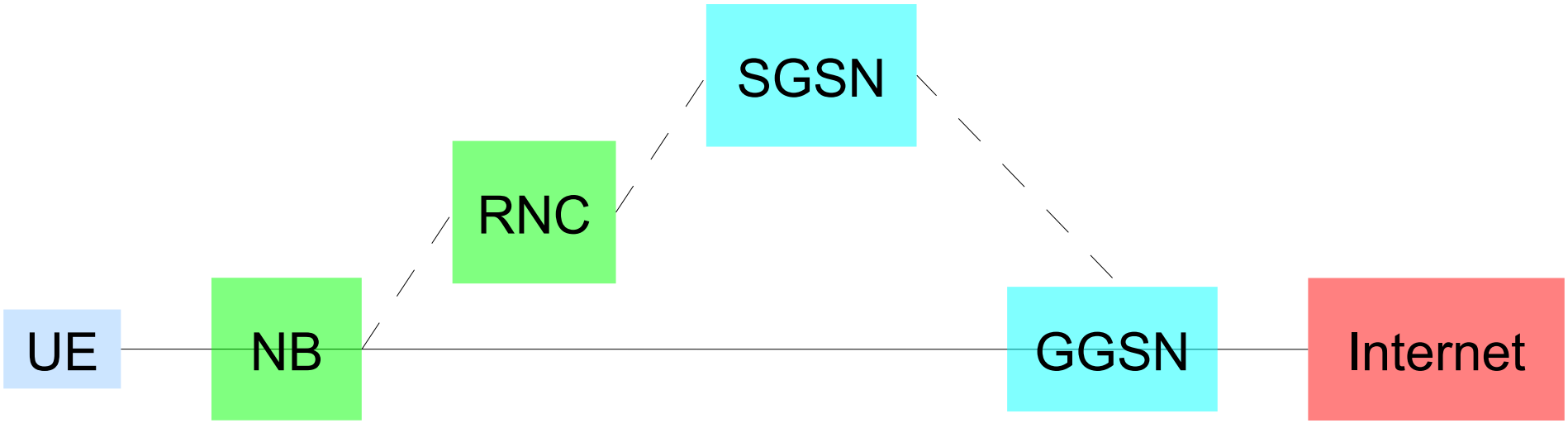
GSM/UMTS network



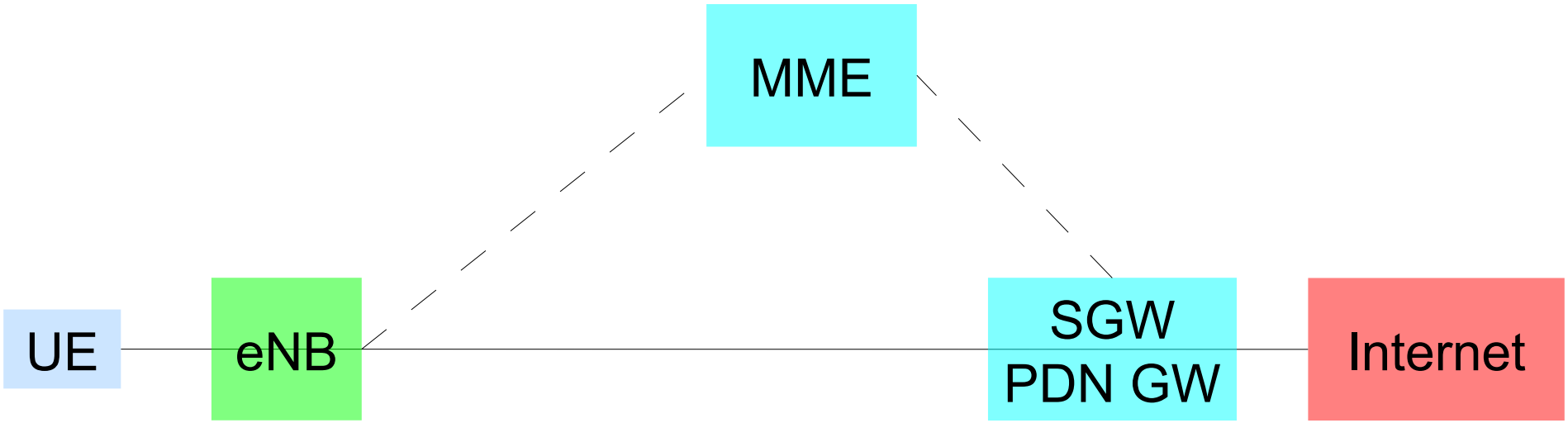
Evolution to One tunnel



Evolution to I-HSPA



Evolution to LTE



LTE voice service

VoIP with IMS

CS fallback and SR-VCC

NSN Voice over LTE

IP Multimedia Subsystem

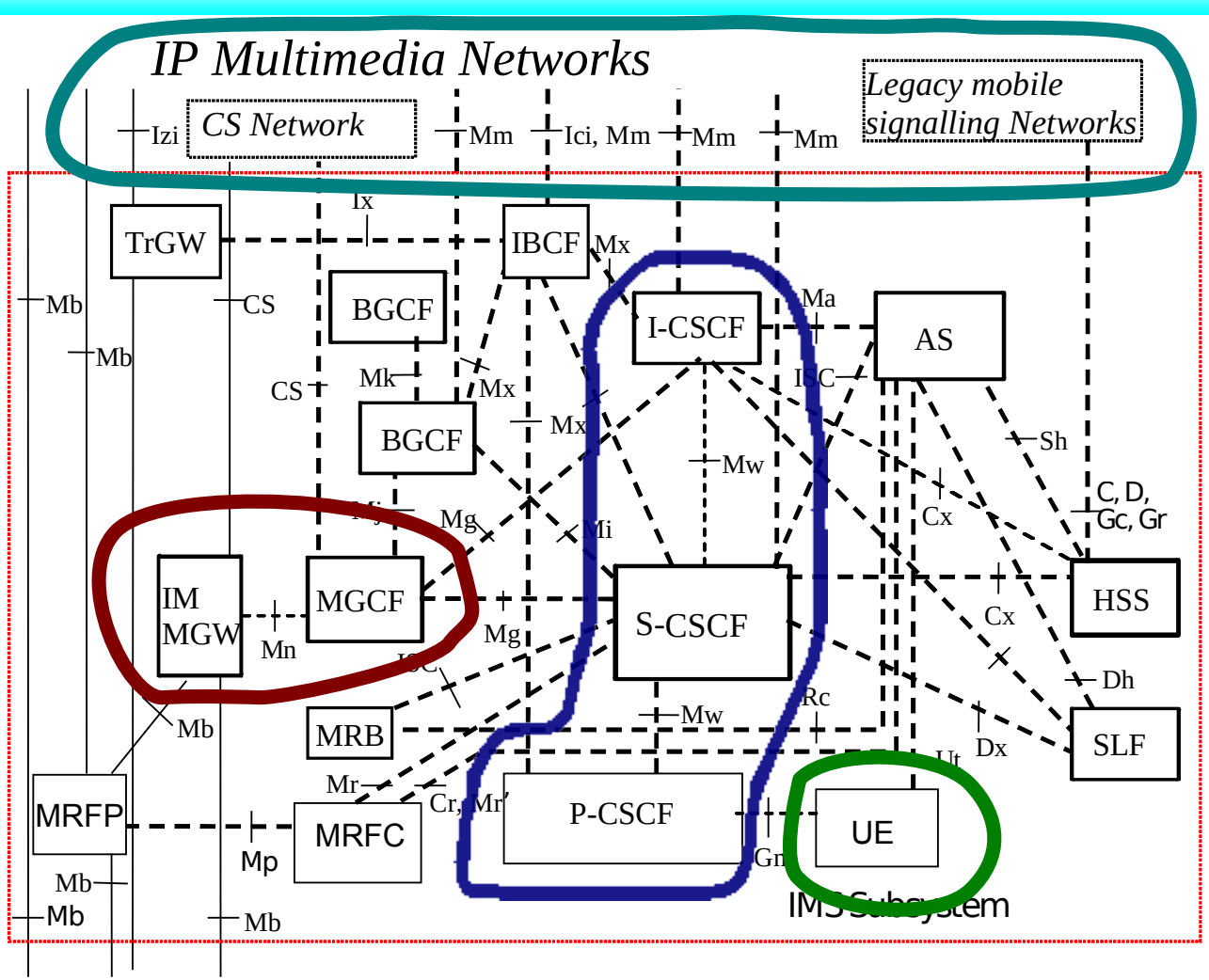


Figure 4.0: Reference Architecture of the IP Multimedia Core Network Subsystem

Source: www.3gpp.org

CS Fallback to 2G/3G

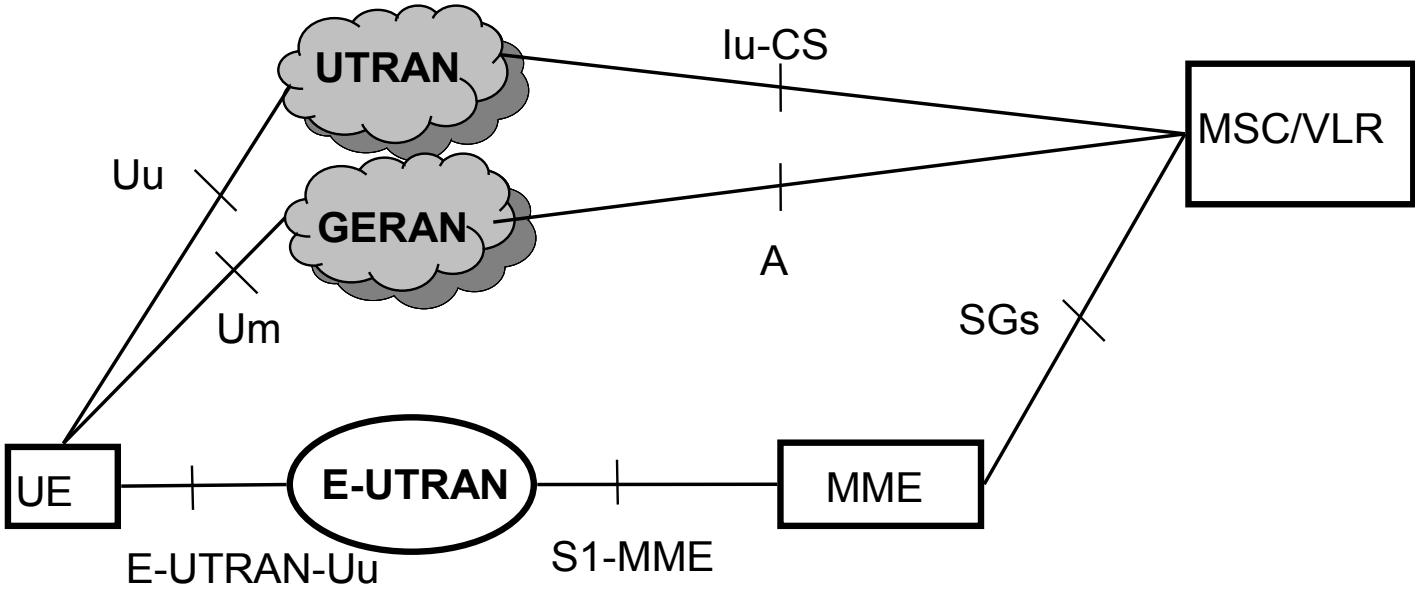


Figure 5.12: Configuration of CSFB

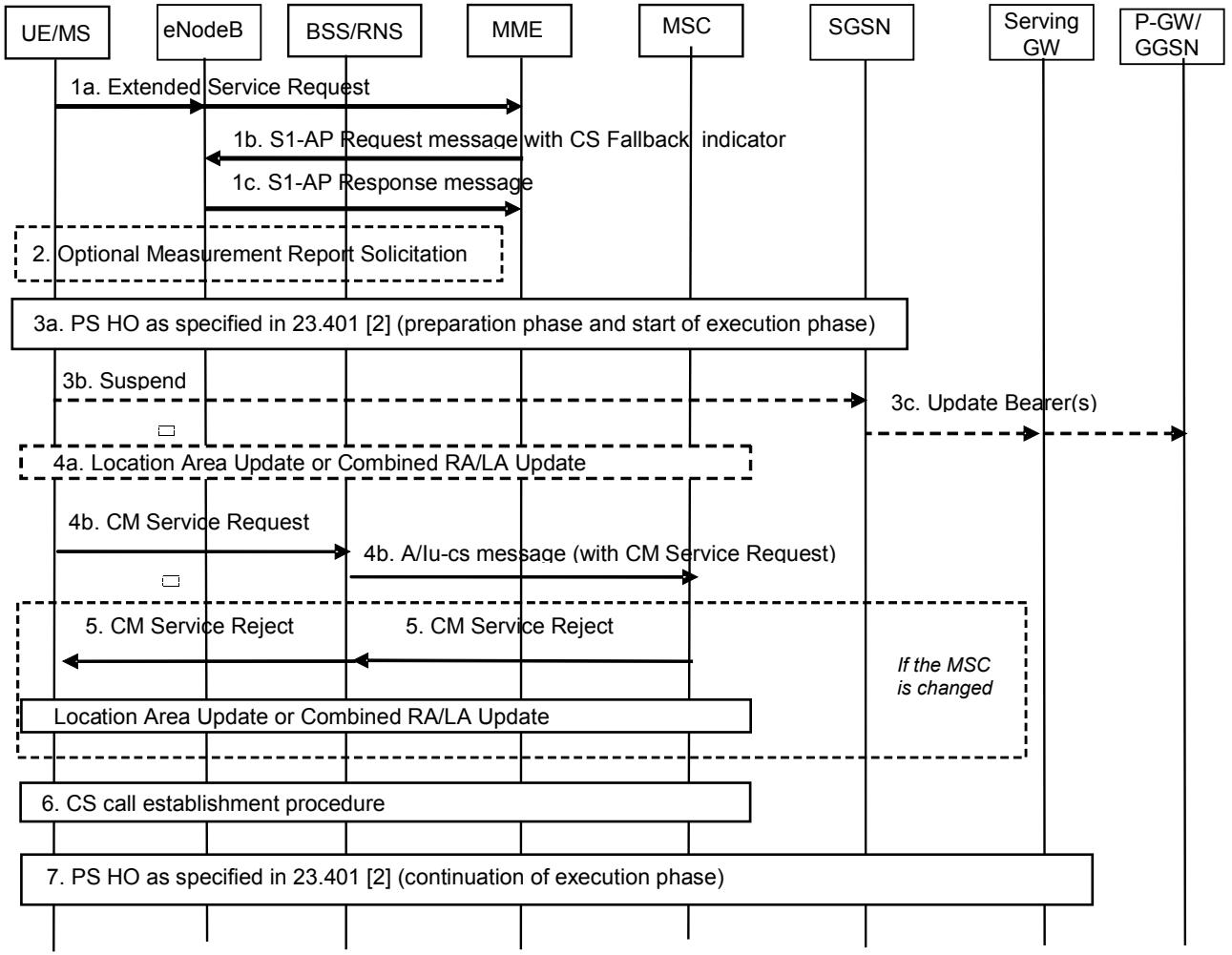
NOTE: The MGW is not shown in the figure 5.12 since the CS fallback in EPS does not have any impacts to the User plane handling.

Source: www.3gpp.org

CSFB signalling

LTE access

2G/3G access



Source: www.3gpp.org

Single Radio Voice Call Continuity to 2G/3G

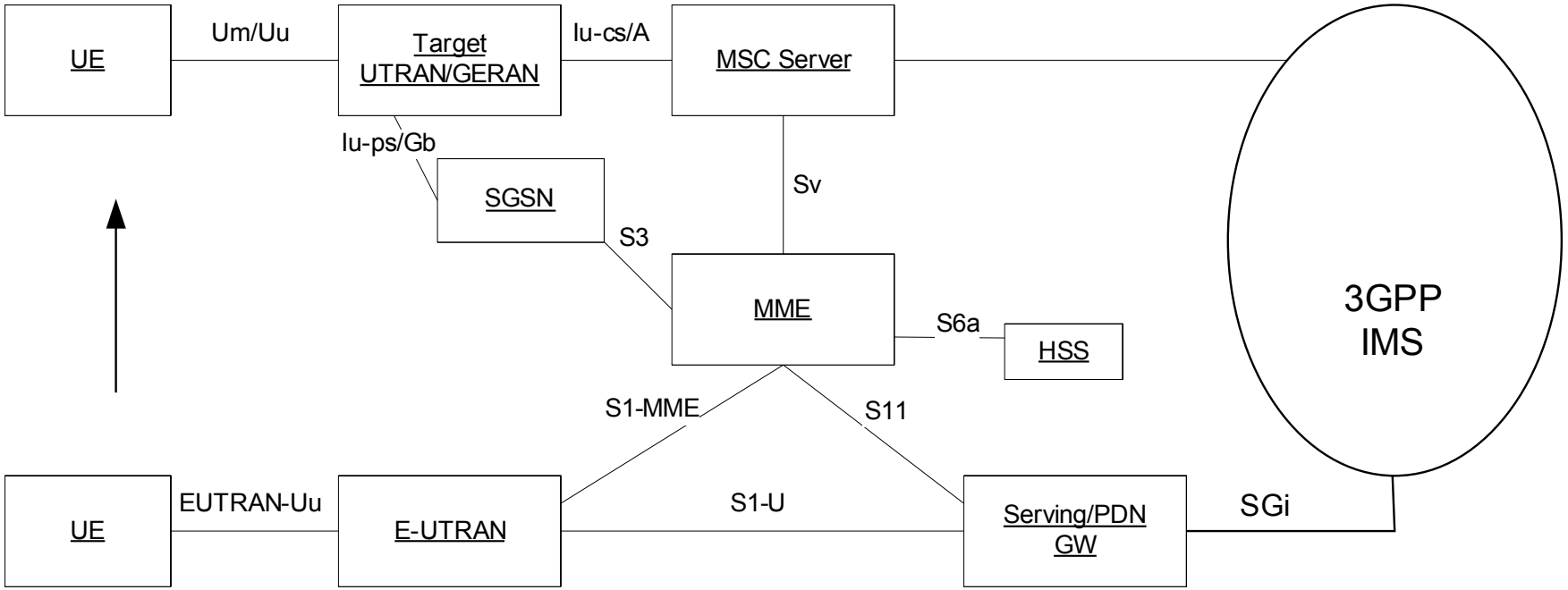


Figure 5.13: SRVCC architecture for E-UTRAN to 3GPP UTRAN/GERAN

Source: www.3gpp.org

References etc.

- 3GPP TS 23.002, 23.204, 23.272, 23.401
- Use the latest spec in seminars and thesis
- Rel 10 topics to look for:
  - Carrier aggregation
  - Relay station
  - Femto BTS and WLAN interworking
  - Access Network Discovery and Selection Function (ANDSF)