3G, 3.5G AND 4G (LTE)
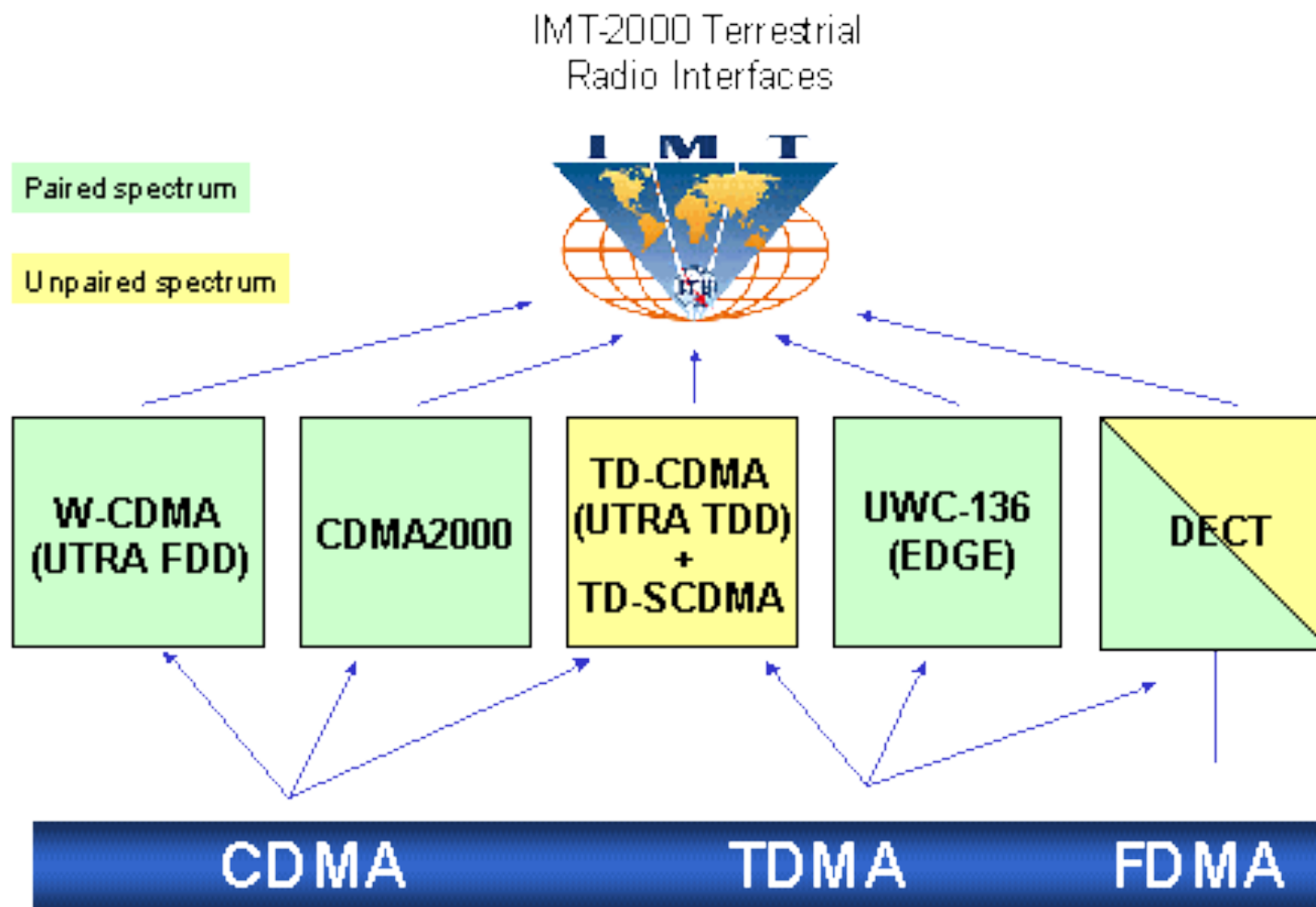
PENGANTAR TELEKOMUNIKASI
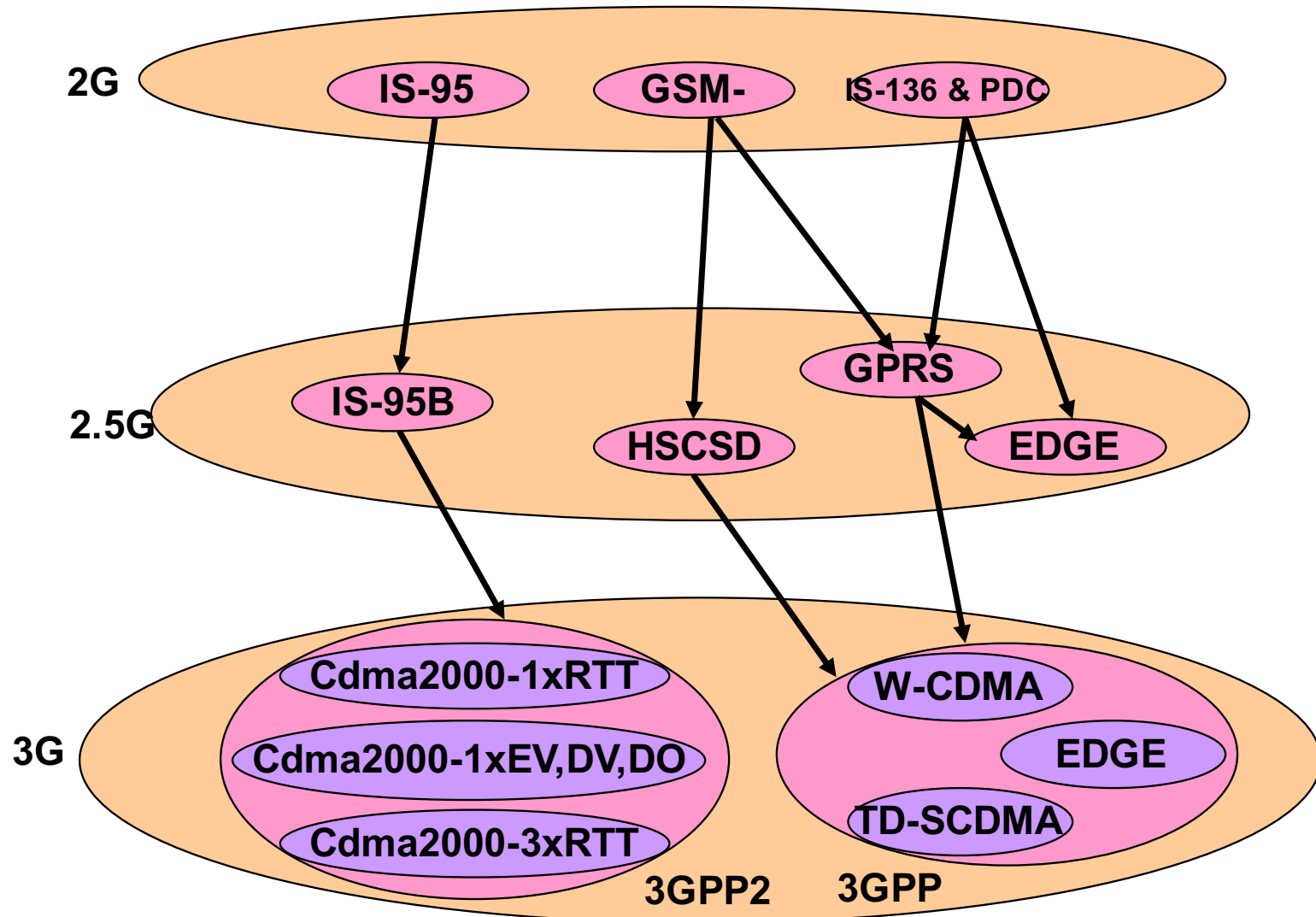
SUSMINI INDRIANI LESTARININGATI, M.T

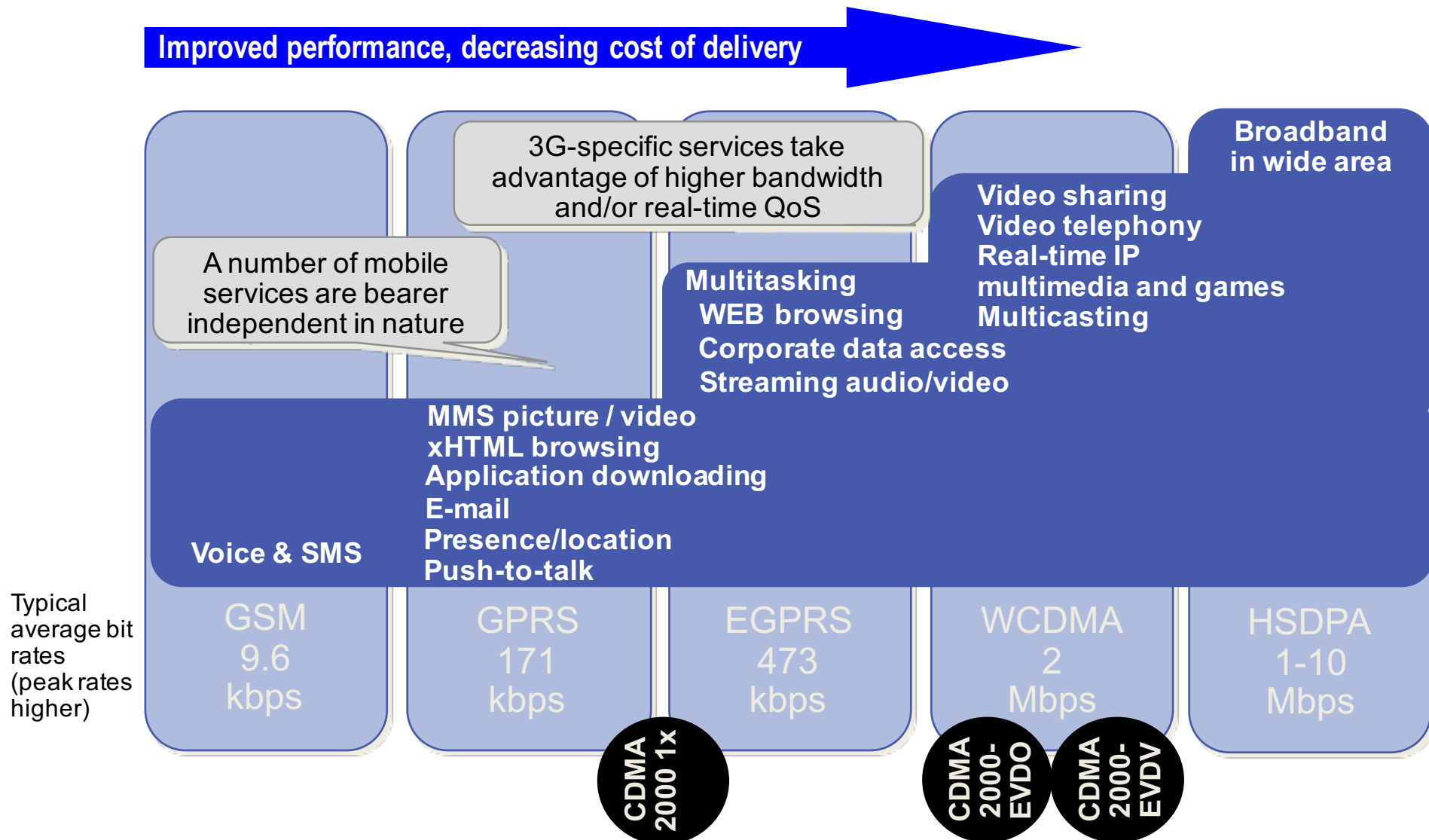# 3G OVERVIEW

▸ 3G is created by ITU-T and is called IMT-2000

IMT-2000 Terrestrial
Radio Interfaces

Paired spectrum

Unpaired spectrum

| W-CDMA (UTRA FDD) | CDMA2000 | TD-CDMA (UTRA TDD) + TD-SCDMA | UWC-136 (EDGE) | DECT |

CDMA   TDMA   FDMA

EVOLUTION FROM 2G

SERVICE ROADMAP

Improved performance, decreasing cost of delivery

3G-specific services take advantage of higher bandwidth and/or real-time QoS

A number of mobile services are bearer independent in nature

Video sharing
Video telephony
Real-time IP
multimedia and games
Multicasting

Broadband in wide area

Multitasking
WEB browsing
Corporate data access
Streaming audio/video

MMS picture / video
xHTML browsing
Application downloading
E-mail
Presence/location
Push-to-talk

Voice & SMS

Typical average bit rates (peak rates higher)

| GSM 9.6 kbps | GPRS 171 kbps | EGPRS 473 kbps | WCDMA 2 Mbps | HSDPA 1-10 Mbps |

CDMA 2000 1x

CDMA 2000-EVDO

CDMA 2000-EVDV

GSM EVOLUTION TO 3G

High Speed Circuit Switched Data
Dedicate up to 4 timeslots for data connection ~ 50 kbps
Good for real-time applications c.w. GPRS
Inefficient -> ties up resources, even when nothing sent
Not as popular as GPRS (many skipping HSCSD)

GSM
9.6kbps (one timeslot)
GSM Data
Also called CSD

HSCSD

Enhanced Data Rates for Global Evolution
Uses 8PSK modulation
3x improvement in data rate on short distances
Can fall back to GMSK for greater distances
Combine with GPRS (EGPRS) ~ 384 kbps
Can also be combined with HSCSD

GSM

GPRS

WCDMA

EDGE

General Packet Radio Services
Data rates up to ~ 115 kbps
Max: 8 timeslots used as any one time
Packet switched; resources not tied up all the time
Contention based. Efficient, but variable delays
GSM / GPRS core network re-used by WCDMA (3G)
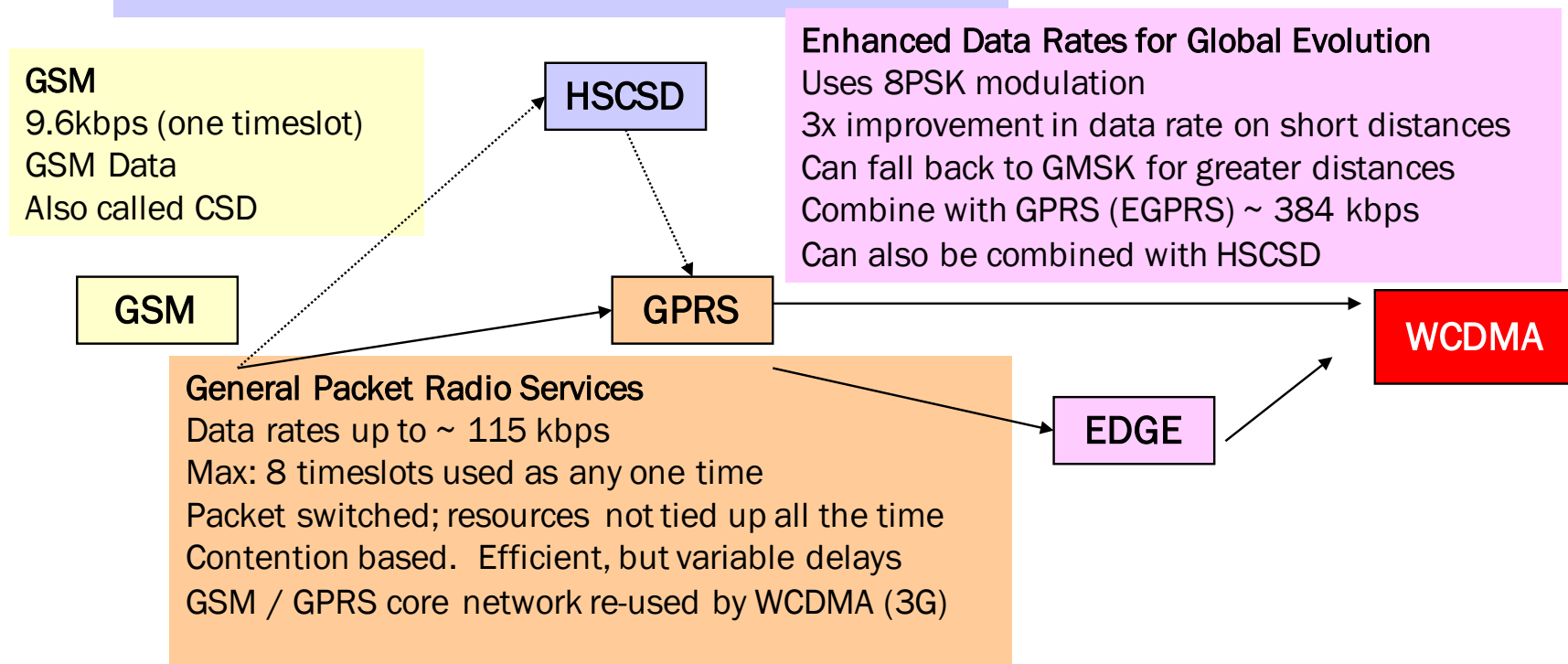
UMTS

▸ Universal Mobile Telecommunications System (UMTS)

▸ UMTS is an upgrade from GSM via GPRS or EDGE

▸ The standardization work for UMTS is carried out by Third Generation Partnership Project (3GPP)

▸ Data rates of UMTS are:

  ▸ 144 kbps for rural

  ▸ 384 kbps for urban outdoor

  ▸ 2048 kbps for indoor and low range outdoor

UMTS FREQUENCY SPECTRUM

▸ UMTS Band

▸ 1900-2025 MHz and 2110-2200 MHz for 3G transmission

▸ In the US, 1710–1755 MHz and 2110–2155 MHz will be used instead, as the 1900 MHz band was already used.

UMTS ARCHITECTURE

Note: Interfaces have been omitted for clarity purposes.
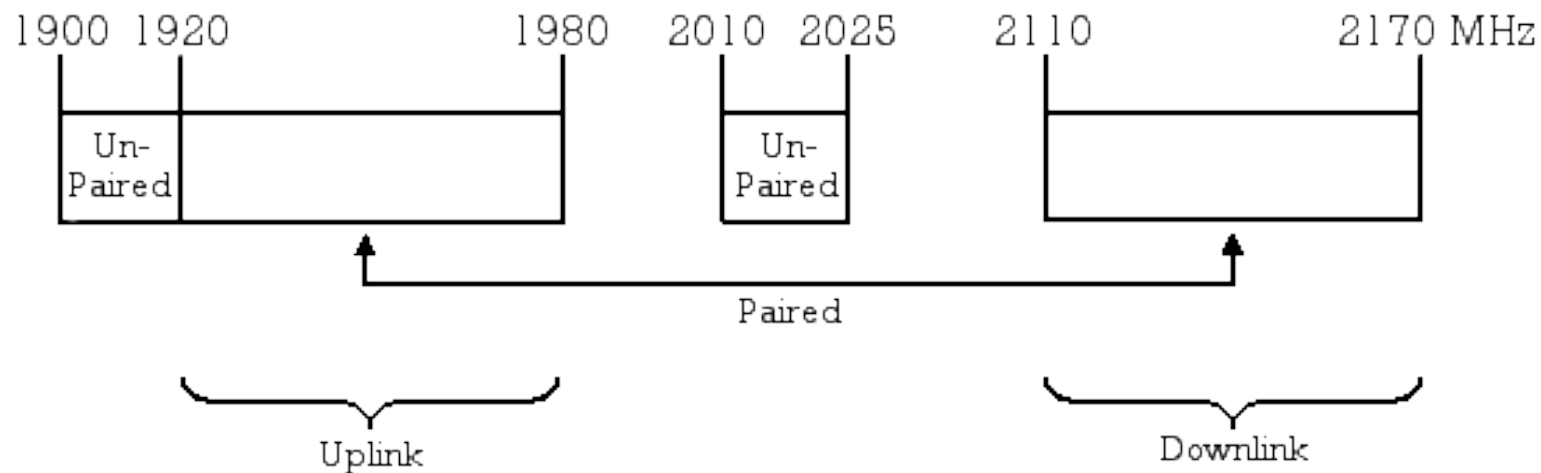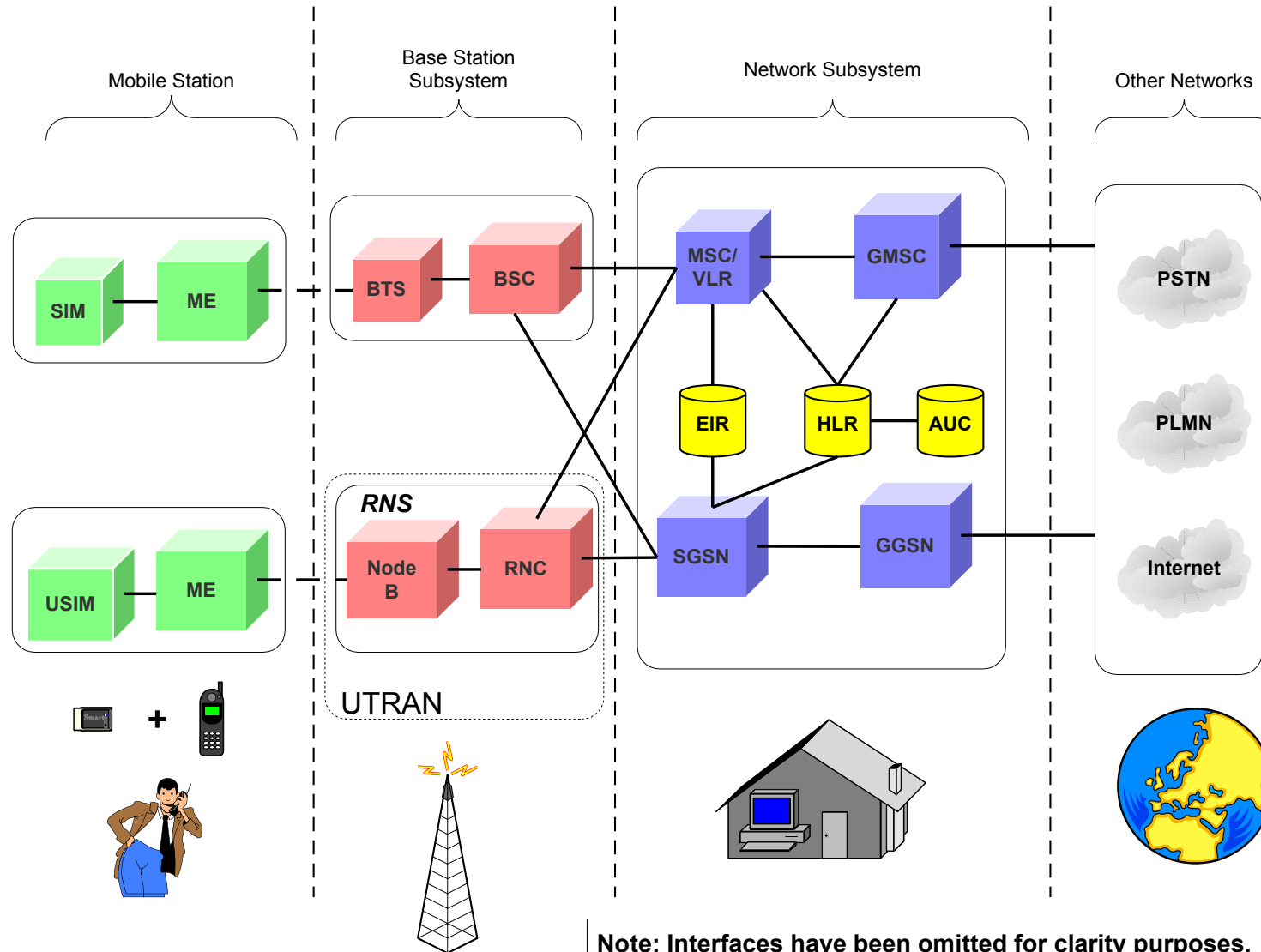
UMTS NETWORK ARCHITECTURE

▸ UMTS network architecture consists of three domains

　▸ Core Network (CN): Provide switching, routing and transit for user traffic

　▸ UMTS Terrestrial Radio Access Network (UTRAN): Provides the air interface access method for user equipment.

　▸ User Equipment (UE): Terminals work as air interface counterpart for base stations. The various identities are: IMSI, TMSI, P-TMSI, TLLI, MSISDN, IMEI, IMEISV

3.5G (HSPA)

▸ High Speed Packet Access (HSPA) is an amalgamation of two mobile telephony protocols, High Speed Downlink Packet Access (HSDPA) and High Speed Uplink Packet Access (HSUPA), that extends and improves the performance of existing WCDMA protocols

▸ 3.5G introduces many new features that will enhance the UMTS technology in future. 1xEV-DV already supports most of the features that will be provided in 3.5G.

4G (LTE)

▸ LTE stands for Long Term Evolution

▸ Next Generation mobile broadband technology

▸ Promises data transfer rates of 100 Mbps

▸ Based on UMTS 3G technology

▸ Optimized for All-IP traffic

ADVANTAGES OF LTE

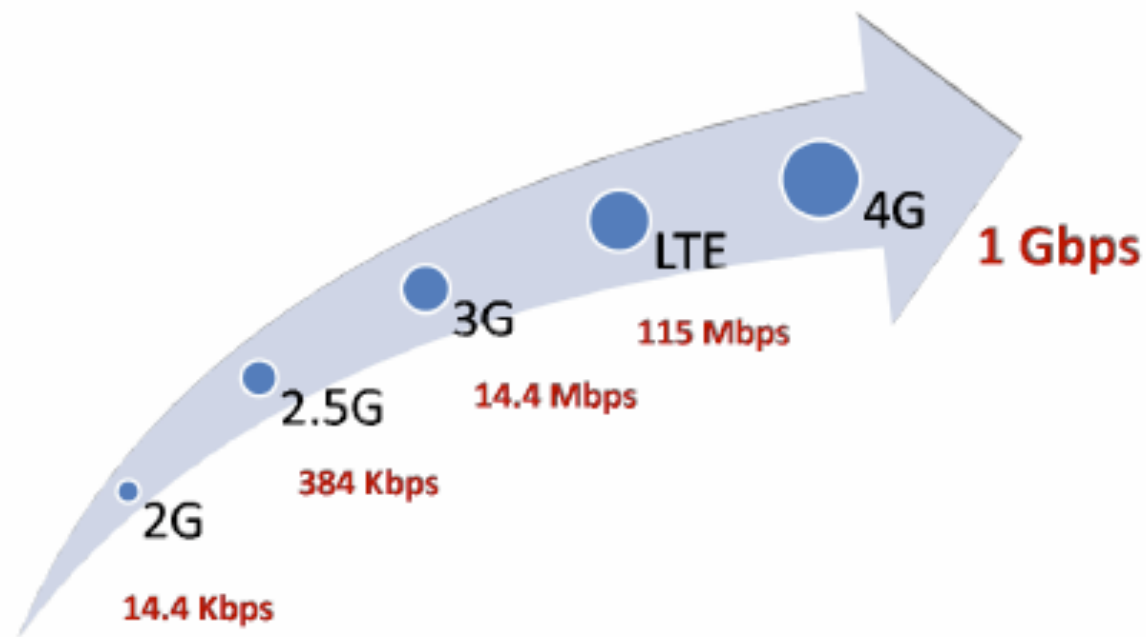|	
▸ High network throughput ▸ Low latency ▸ Plug & Play architecture ▸ Low Operating Costs ▸ All-IP network ▸ Simplified upgrade path from 3G networks	▸ Faster data downloads/uploads ▸ Improved response for applications ▸ Improved end-user experience
for Network Operators	*for* End Users

COMPARISON OF LTE SPEED

LTE ARCHITECTURE

NAS security
Idle state mobility handling
EPS bearer control

Radio bearer control
Inter-cell RRM
Connection mobility Control
Radio admission control

Mobility anchoring

UE IP address allocation
Packet filtering
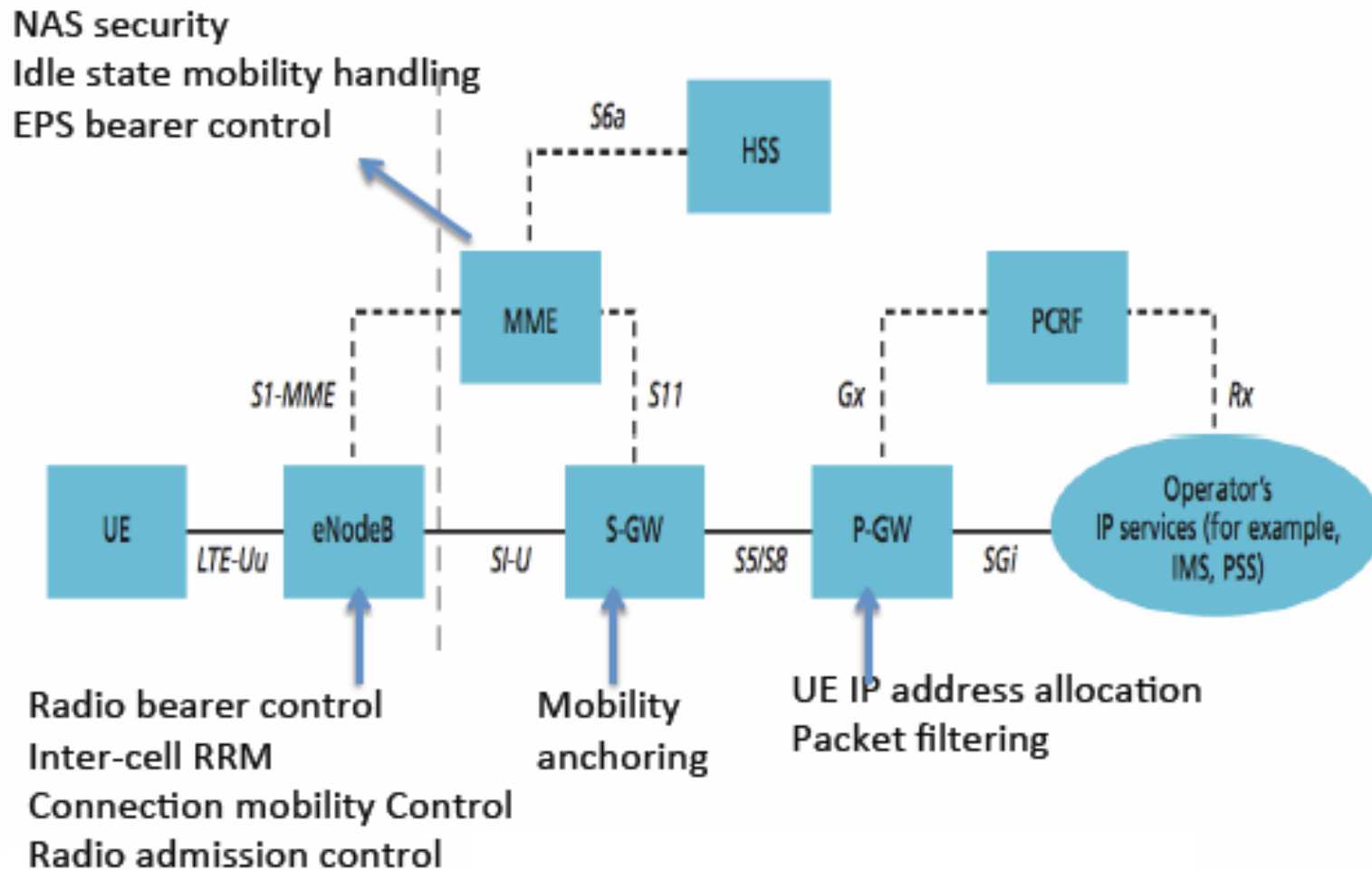
▸ Functional changes compared to the current UMTS architecture