EEE4121F
Mobile and Wireless Networks

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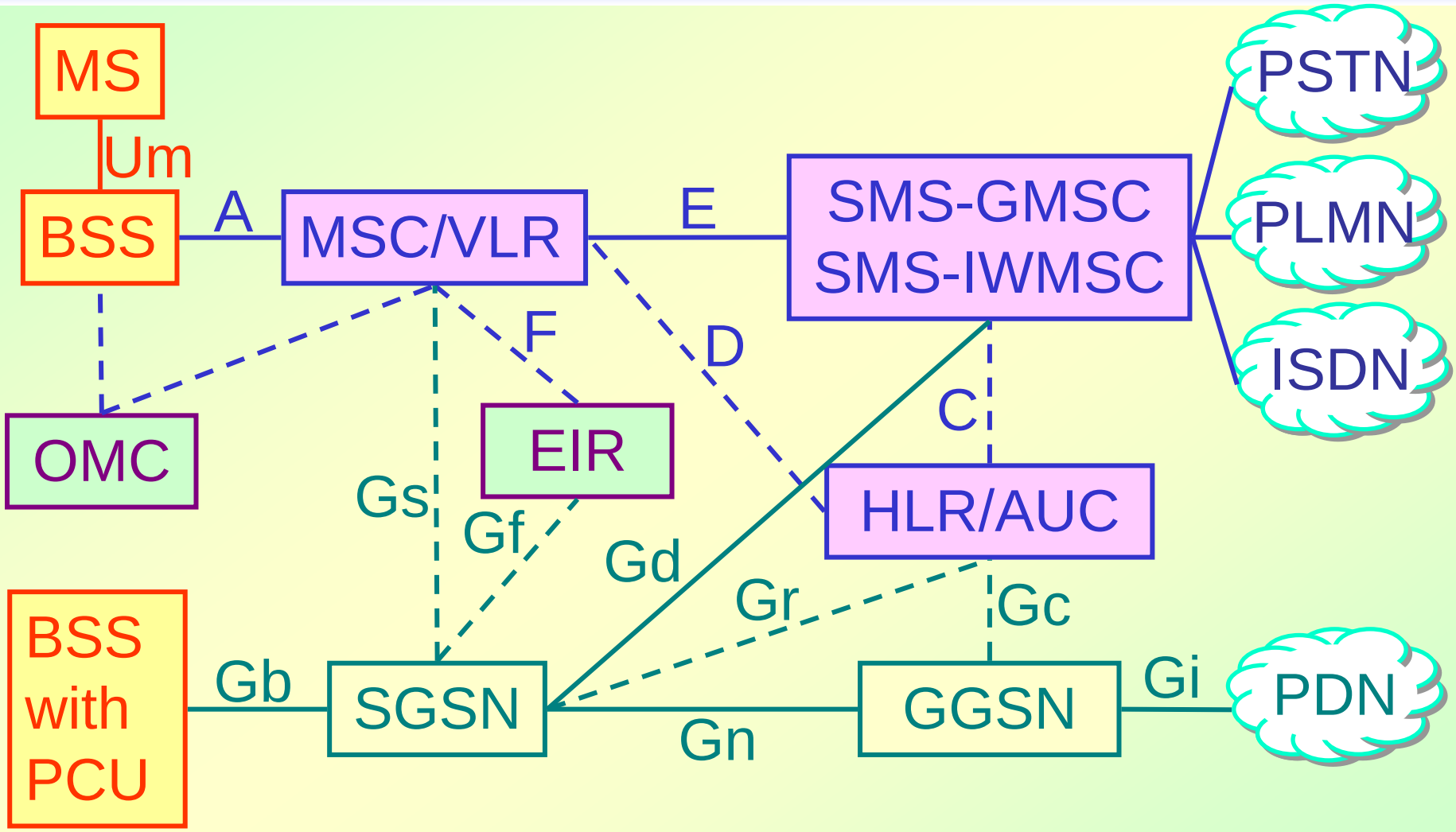
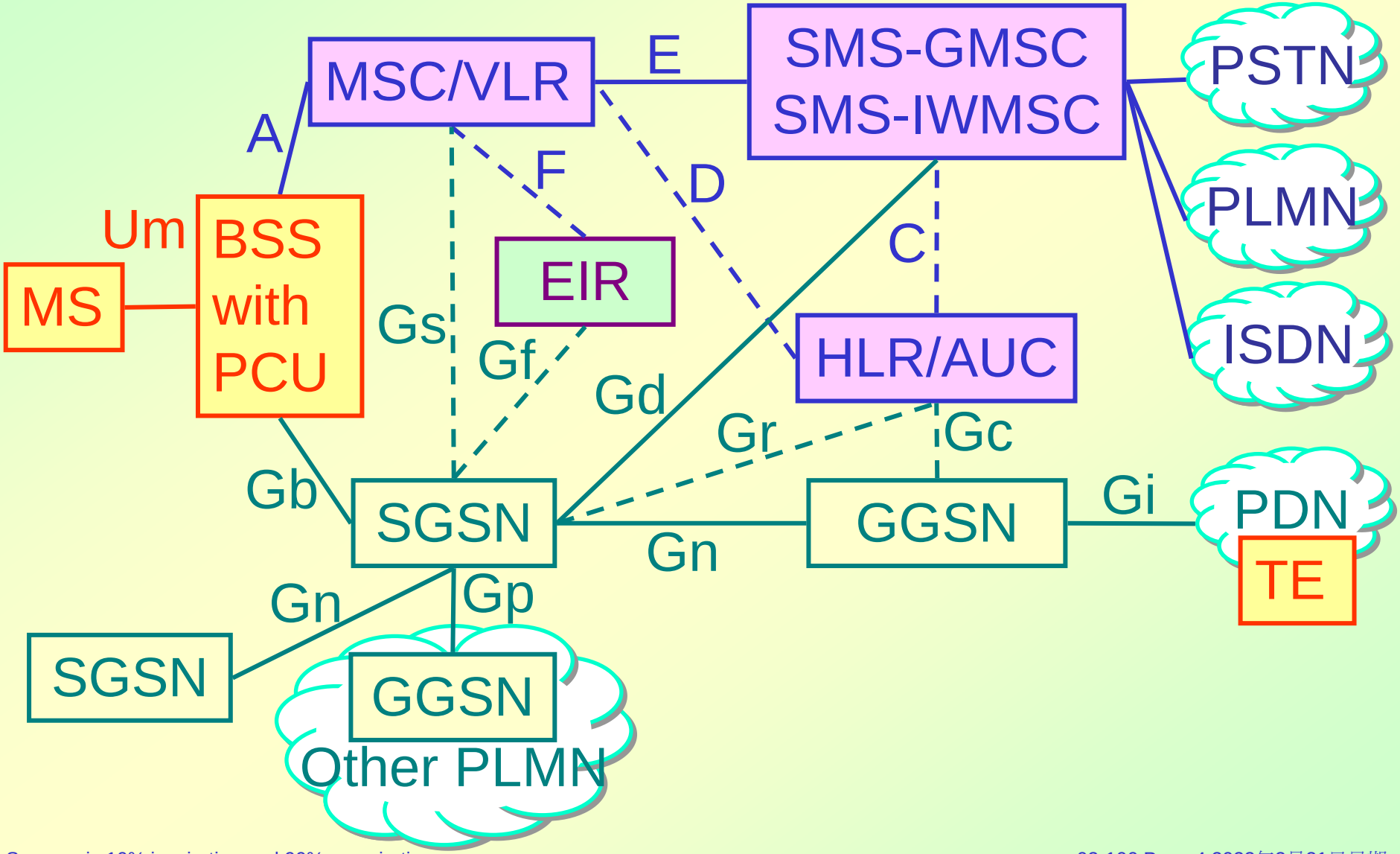
Evolution Path of GSM to GPRS

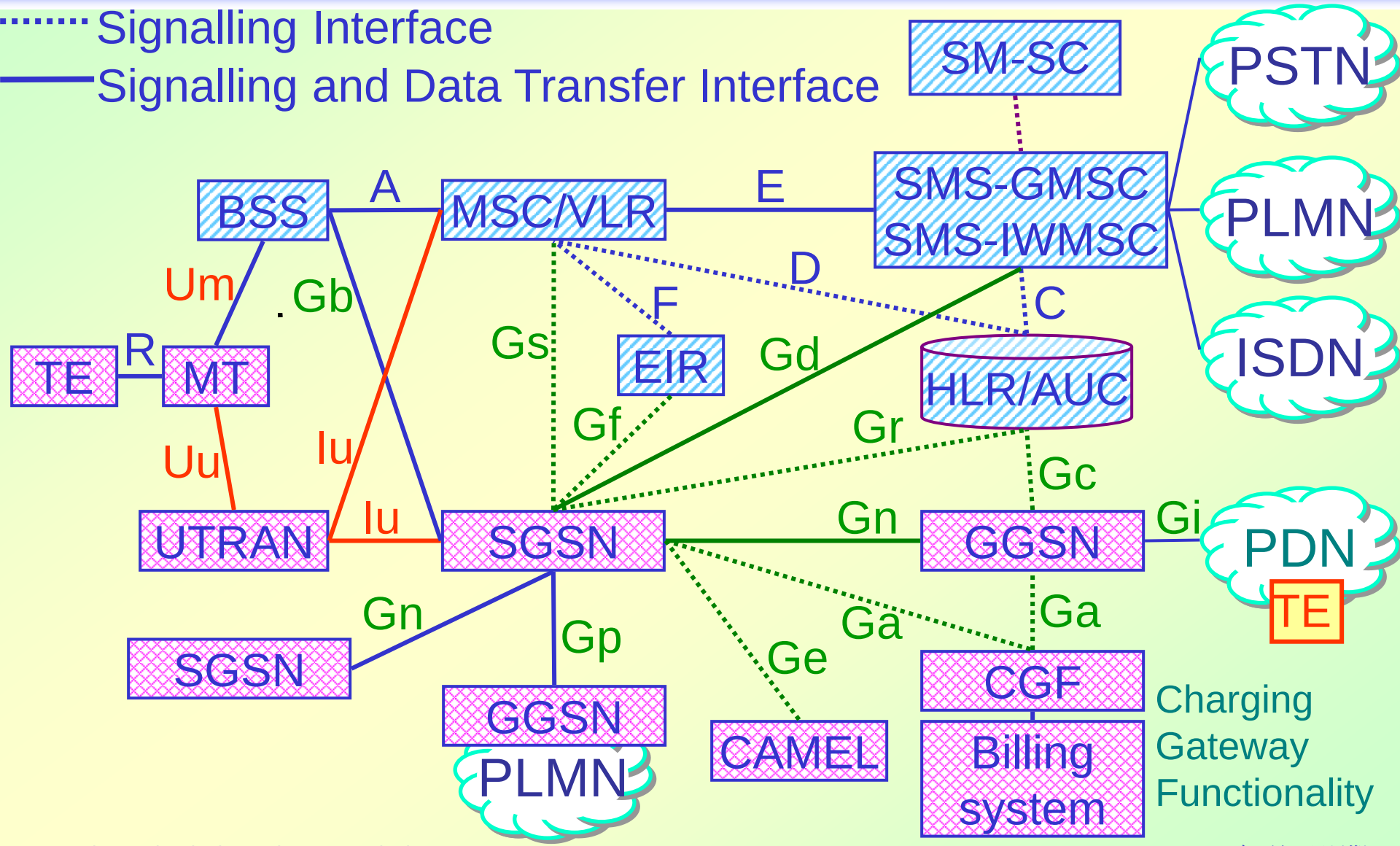
GPRS
New NE and Interfaces



GPRS Logical Architecture



GPRS Logical Architecture
TS 23.060



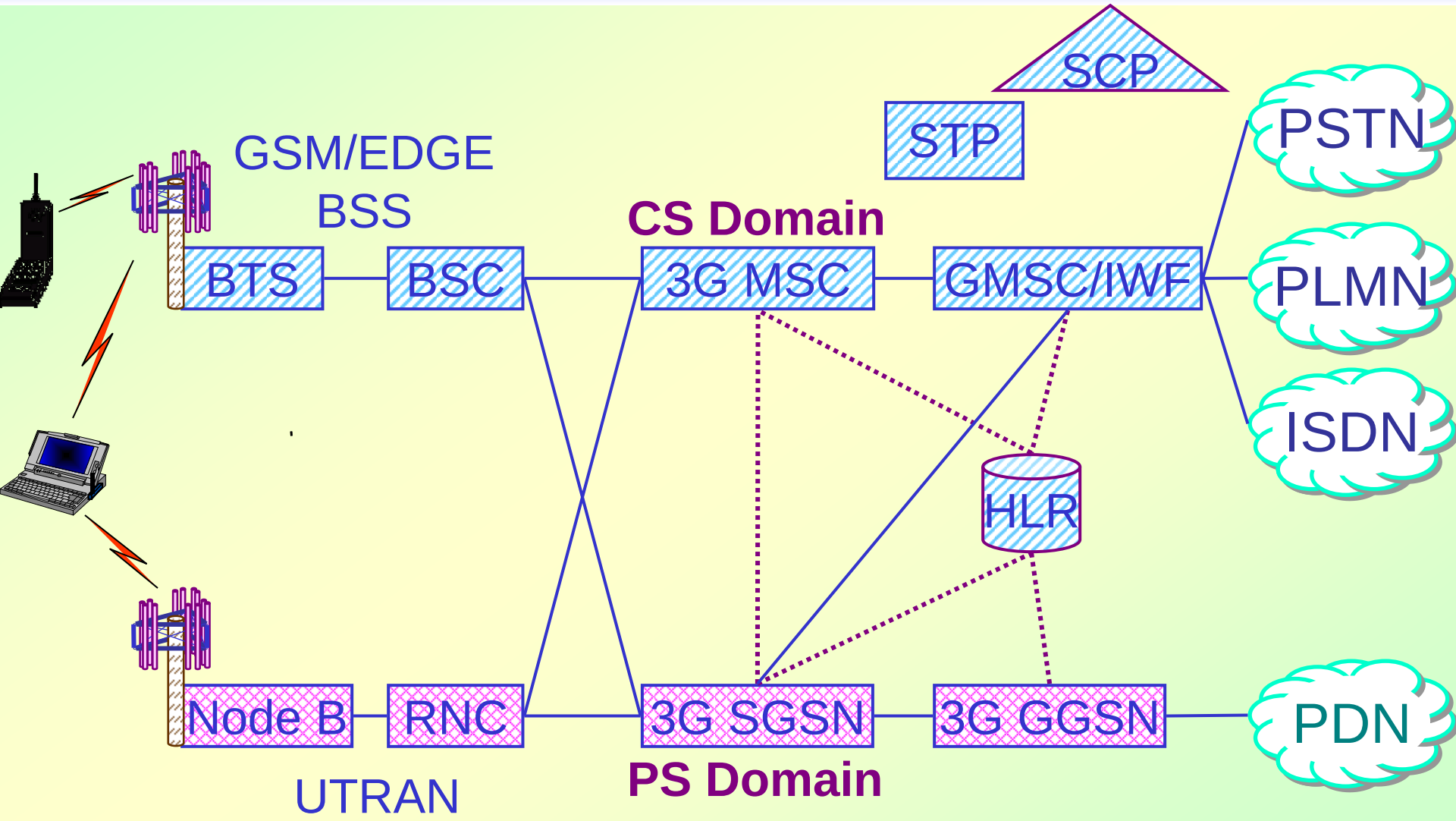
GPRS Logical Architecture

- The Gb interface connects the BSS with the SGSN. It carries the GPRS traffic and signalling between GSN radio network (BSS) and the GPRS part
- The Gc interface is the signaling path between GGSN and HLR, which may be used by the GGSN to query a user's location and profile in order to update its location register
- The Gs interface connects the data bases of SGSN and MSC/VLR so that paging requests of circuit switched GSM calls can be performed via the SGSN. It is used to deal efficiently with terminals that are attached to both GPRS and GSM traffic
- The Gn interface is defined between 2 GSN within the same PLMN. It provides a data and signaling interface in the intra-PLMN backbone. They allow the GSNs to exchange user profiles when a mobile station moves from one GSN area to another
- The Gp interfaces are defined between two GSNs in various PLMNs. It provides the same function as the Gn but it also allows inter-PLMN networking e.g. security, routing

GPRS Logical Architecture

- Across the Gf interface, the SGSN may query the IMEI of a mobile station trying to register with the network
- The Gr interface is used to exchange this information between HLR and SGSN. For example, the SGSN informs the HLR about the current location of the MS
- To exchange messages of the short message service (SMS) via GPRS, the Gd interface is defined. It interconnects the SMS gateway MSC (SMS-GMSC) with the SGSN
- The Gi interface is a reference point that connects the PLMN with external public or private PDNs, such as the Internet or corporate intranets
- The R reference point is between TE and MT, it connects TE and MT thereby allowing laptop/PC to transmit data over the GSM phone.

UMTS Network Architecture



Wireless Data Network Convergence

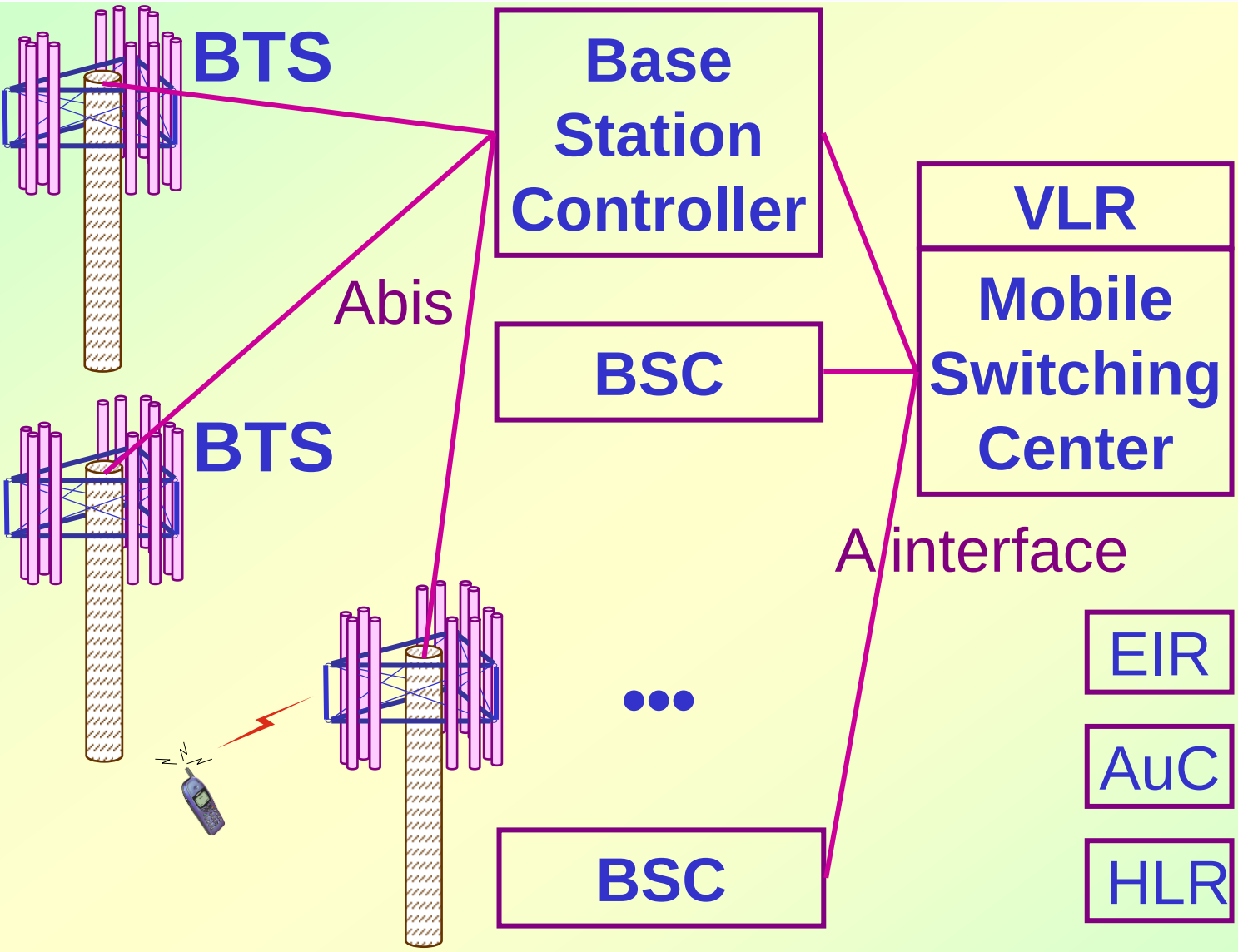
3GPP

3GPP2

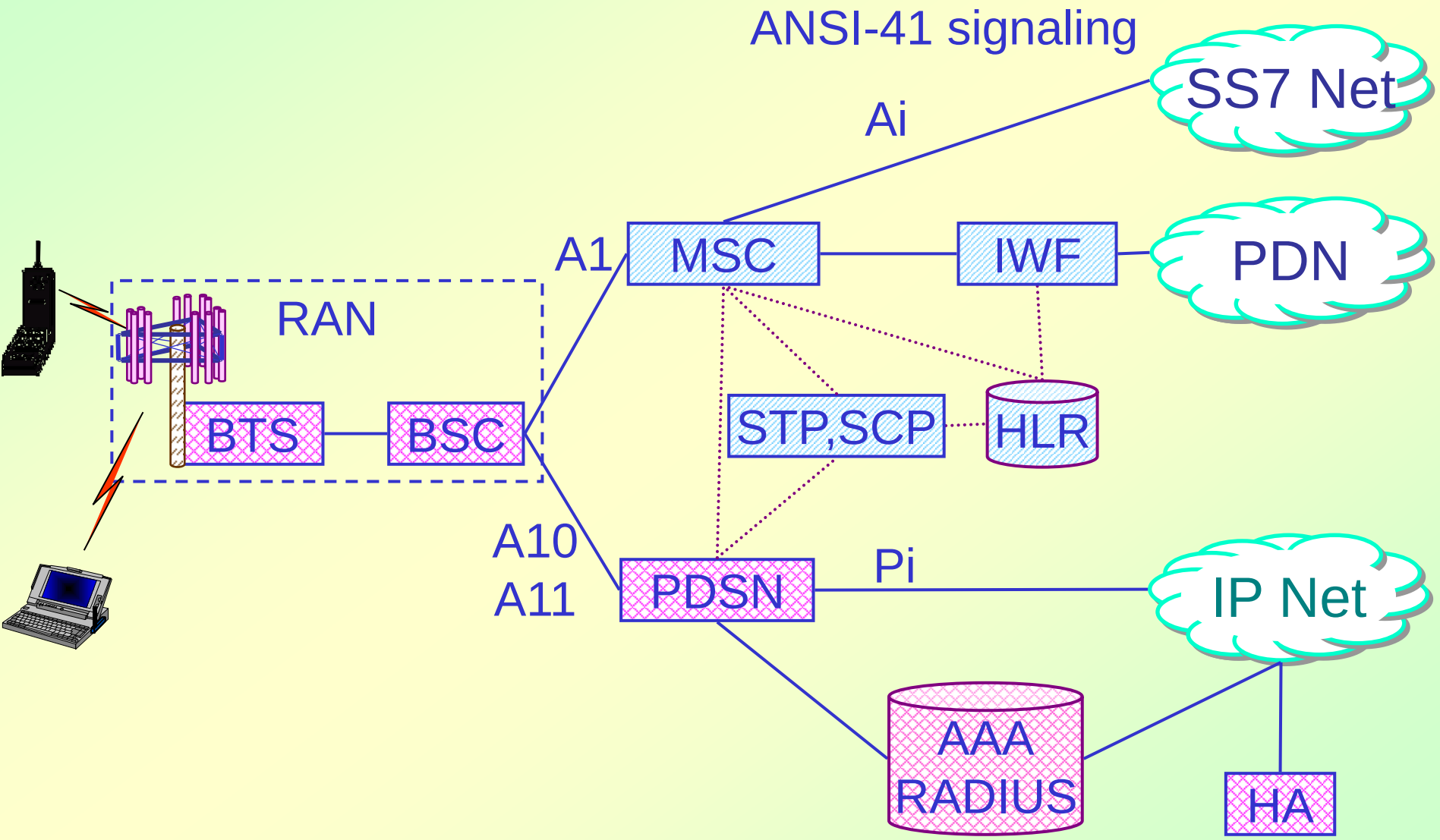
Evolution Path of IS-95 and cdma2000

	2G	2.5G	3G
1.25MHz CDMA MC-CDMA	IS-95; IS-95A (9.6kbps); IS-95B (14.4kbps)	Cdma2000 1X (twice voice capacity, average data rate at 144kbps)	1xEVDO Release 0 (2.4Mbps, separate carrier for data) EVDV (2.4Mbps, same carrier for data and voice) EVDO Rev A (3.1/1.8Mbps down/uplink) EVDO Rev B (5Mbps)
			Cdma2000 3X

IS95A/B CDMA Network (Similar to GSM)



CDMA2000 Network Architecture



Wireless Networks and Systems

GSM

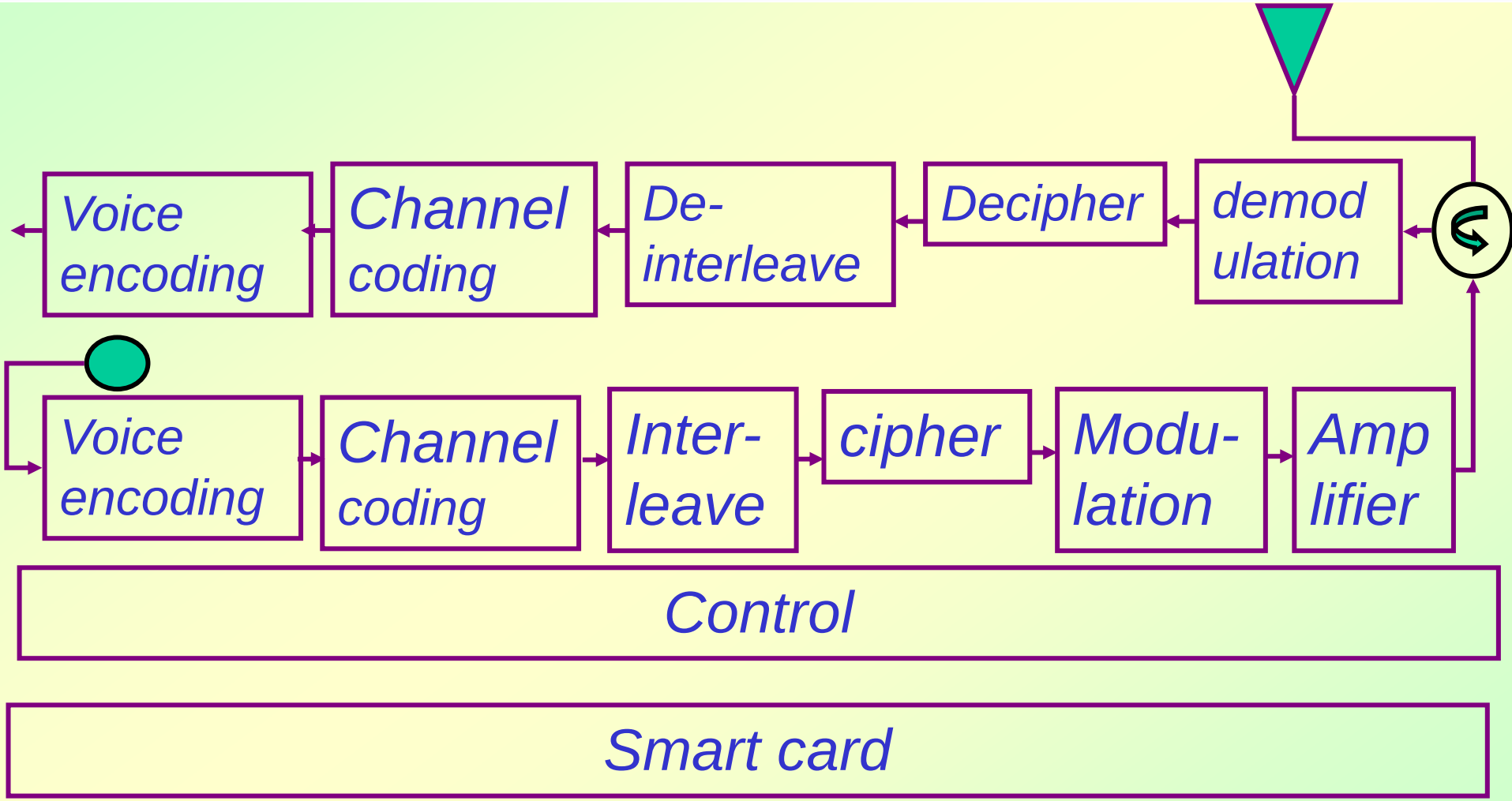
Physical Channels

System Acquisitions and Procedures

The Radio Link Properties

The GSM Receiver

Mobile Station (MS)



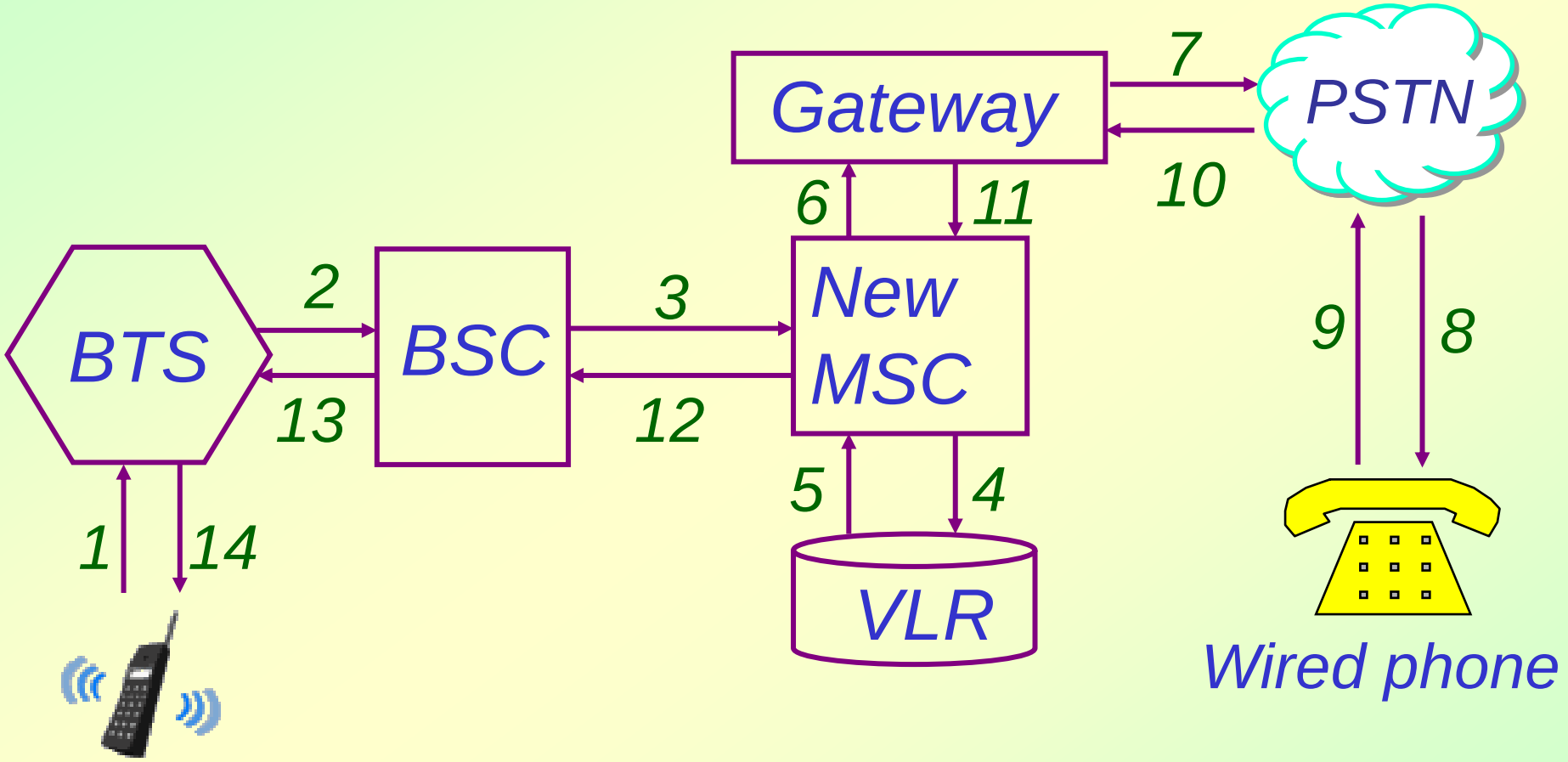
Initial Synchronization

- The MS finds the carrier where FCCH/SCH/BCCH are being transmitted (usually the strongest carrier)
- The synchronization is accomplished in 3 steps

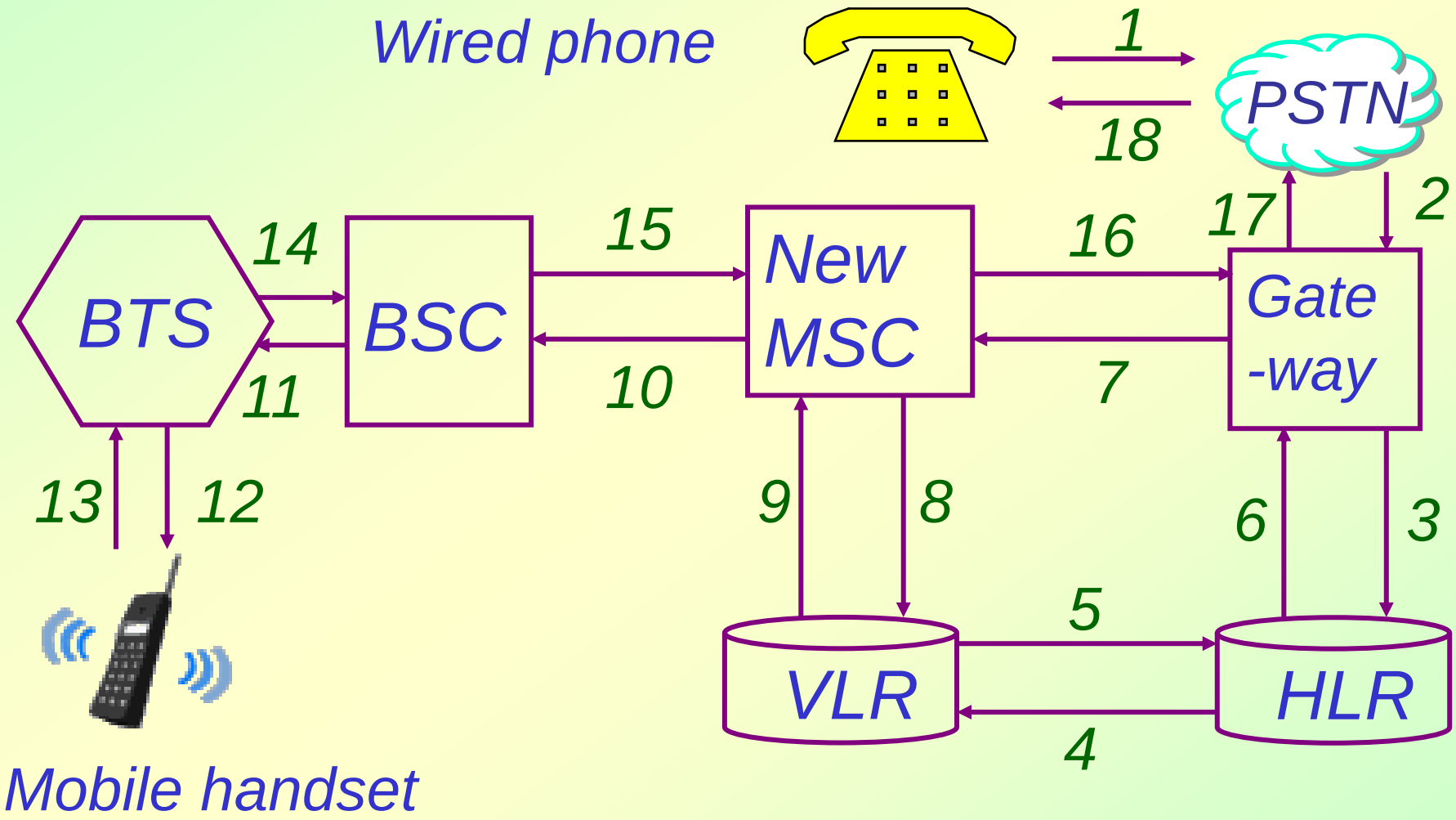
Initial Synchronization Steps

1) Frequency synchronization FCCH (Frequency Correction Channel): The mobile searches for a bump at 67 Hz (caused by FCCH) above the carrier center.
2) Time synchronization SCH is accomplished using the SCH. The SCH follows the FCCH in the TDMA multi-frame.
3) Read System Parameters BCCCH (Broadcast Control Channel): SCH informs the mobile about the cell's training sequence, which is used to read BCCH and complete the network acquisition process.

Mobile Originating A Call

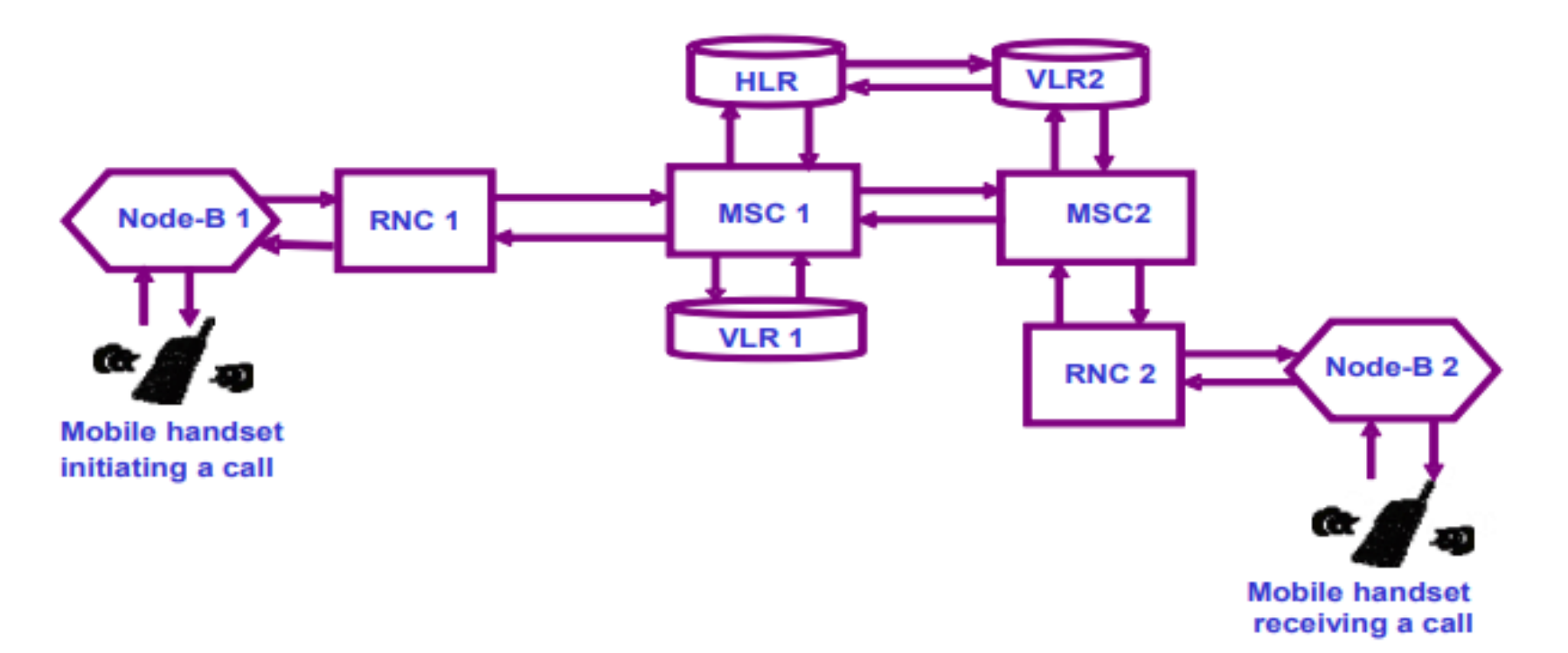


Mobile Receiving A Call



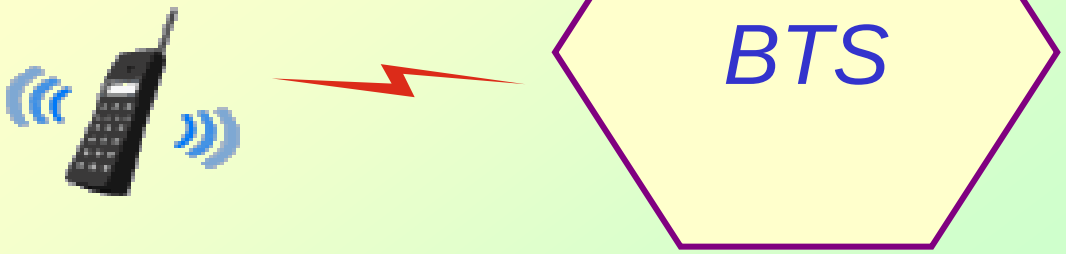
Example 1

Using relevant diagram(s), explain the sequence of interactions between the various elements required to setup a voice call from a mobile station connected to MTN 3G network to another mobile station connected to the same MTN 3G network but under a different Mobile Switching Centre.



Measurements

- The measurements are conducted on the uplink and downlink channels (slow association control)
- Downlink:
  - Power
  - BER (the training sequence)
  - Neighboring power
- Uplink:
  - Power
  - BER (the training sequence)
  - Distance



Power Control

- To minimize co-channel interference and to conserve power, both the mobiles and the Base Transceiver Stations operate at the lowest power level that will maintain an acceptable signal quality

- The BTSs perform timing measurements; they also perform measurements on the power level of the different mobile stations. These power levels are adjusted so that the power is nearly the same for each burst

- The BTS controls its power level. The MS measures the strength and the quality of the signal between itself and the BTS. If the mobile station does not receive correctly the signal, the BTS changes its power level and retransmits.

Power Control

- The MS must set its power level as commanded by the Base Station. [Slow Associated Control Channel(SACCH) & channel assignment].
- The power adjustment is performed over 16 steps of 2 dB each.
- The base station may (optionally) control its own transmitted power to reduce interference to mobiles in other cells.
- When the base station power is controlled, it also adjusts the power over 16 steps with 2 dB per step.

Mobile and Wireless Networks

Between two evils choose neither; between two goods choose both.

"The world stands aside to let anyone pass who knows where he is going."
– David Starr Jordan

"Hell and earth cannot diminish those who heaven will increase"
– Matthew Henry