3. Mobile Network Generations

• First Generation
• Second Generation (**2G**)
• Third Generation   (**3G**)
• Fourth Generation (**4G**)
• The 5G revolution   (**5G**)

Standard	1G	2G	3G	4G	5G
Deployment	1980	1990	2001	2010	Beyond 2020
Frequency Band	800 MHz	900 MHz	2100 MHz	2600 MHz	3-90 GHz
speed	2 kbps	64 kbps	2 Mbps	1 Gbps	20 Gbps
Technology	Analogue Cellular	Digital Cellular TDMA	CDMA, UMTS	LTE-A, Wi-Fi OFDMA	Multi RAT, Wi-Fi, Wi-Gig
Services	Voice	Digital Voice, SMS, GPRS Low rate data	Higher quality audio & video calls, mobile broadband	High data rate, wearable devices	Very high data rate, Cloud services, 4K videos D2D, M2M, IoT
Multiplexing	FDMA	TDMA	CDMA	OFDMA	OFDM, FBMC, NOMA
Handover	No	Horizontal	Horizontal	Horizontal/Vertical	Horizontal/Vertical

3.1 The first generation phones

1G phones were analogue mobiles and they presented a revolution in the field of communication. First telephone network was built in 1977 by the company named Bell. This network was based on 10 radio stations. After that we saw AMPS (American Advanced Mobile Phone System) that presented a great improvement over the first network and it used different frequencies that allowed easy communication between two people. This generation used frequency of 450-900 MHz. Until 1996 this first generation of cell phones developed a lot. Some of the best 1G phone models in that time were:

- **Nokia Mobira Talkman** – this phone was the first phone on the world that was easy to transport. It was released in 1984.
- **Motorola 8500X** – great Motorola phone of first generation of phones was released in 1987 and it was very popular phone all around the world.

3.2   Second Generation (2G)

The most popular wireless access technology, GSM (Global System for Mobile Telecommunications), was defined in its first version in 1990 by ETSI (European Telecommunications Standards Institute). Initially designed to be used across Europe. the standard is today used all over the world.

GSM is often referred to as a second generation (2G) wireless access technology. GSM uses licensed spectrum, where 900 and 1800 MHz are the most common frequency bands.

GSM uses TDMA (Time Division Multiple Access) technology in the radio interface to share a single frequency between several users. The system assigns sequential timeslots to each user sharing one common frequency. Users are identified via their Subscriber Identity Module (SIM) which is a detachable smart card containing the user's subscription information and his/her phone book. This feature allows users to easily switch handsets.

There were lots of GSM cell phones that developed from 1992 to 2006, here are some of them that were the most successful:

- **Nokia 1011** – we start the list with one of the first GSM phones ever made. This phone maybe isn't exactly the first GSM phone, but it is the first phone that was mass produced.

- **Motorola Micro-TAC 5200** – micro-TAC version of analogue cell phone vas very successful so Motorola decided to make GSM version of the same phone. It was launched in 1994 and it presented an introduction of Motorola to GSM cell phones battle.

- **Nokia 3310** – this legendary phone was launched in 2000 and it was probably the most popular GSM phone ever made. Some sources say that Nokia 3310 was sold in over 126 million copies. It had lots of different innovative features, some games and it was pretty much indestructible.

GSM Architecture :

The GSM network is built up of the mobile station (MS), the base station subsystem (BSS), and the Network and switching subsystem (NSS) (Figure 2). In BSS the Base Station Controller (BSC) controls a number of Base Transceiver Stations (BTSs). NSS consists of two types of switches, the Mobile Services switching Center (MSC) serving subscribers in its service area, and the GMSC (Gateway Mobile Services switching Center) connecting the mobile network to the Public Switched Telephony Network (PSTN).
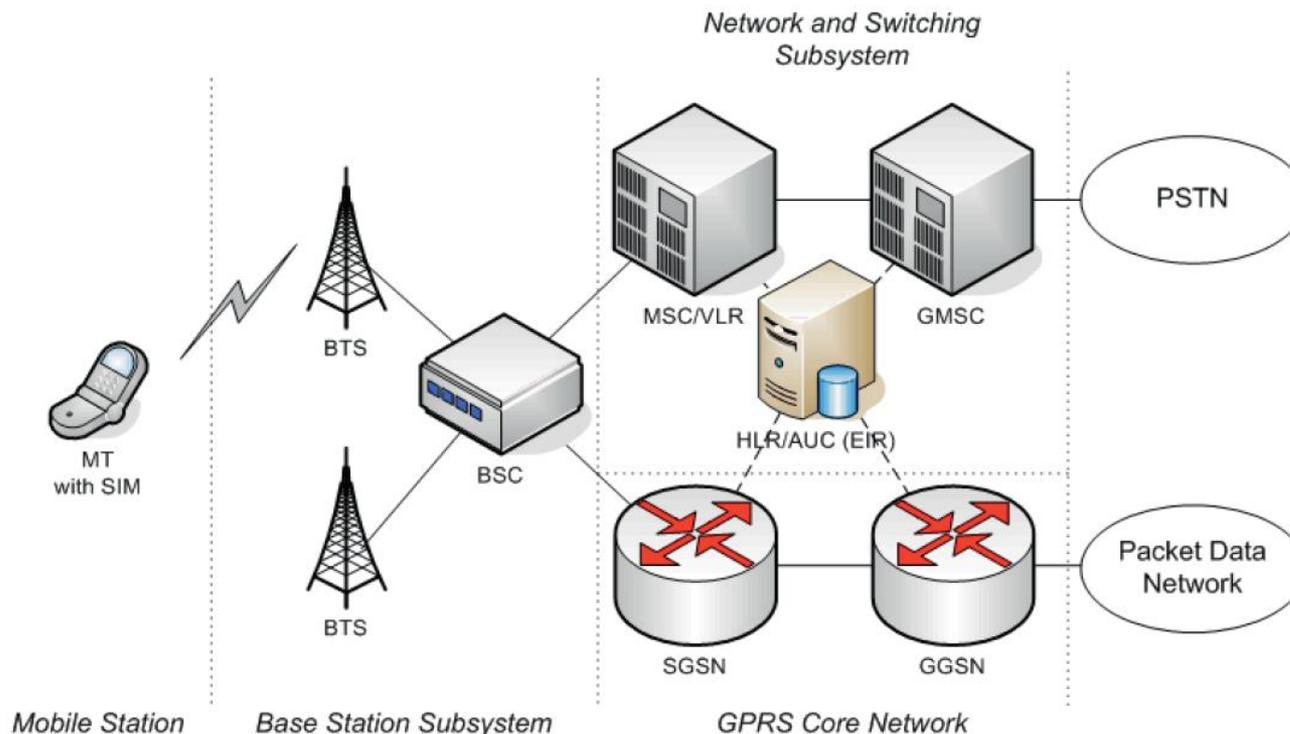
Also, a number of databases are present in the **NSS**. Subscriber data is stored in the Home Location Register (**HLR**). In this register there is also information on the identity of the **MSC** that the subscribers are connected to. The Visitor Location Register (**VLR**) that is connected to each **MSC** holds finer granular location data on users in the service area. Finally, **EIR** (Equipment Identity Register) stores information on valid handsets, while **AUC** (Authentication Center) holds data on authentication and encryption parameters.
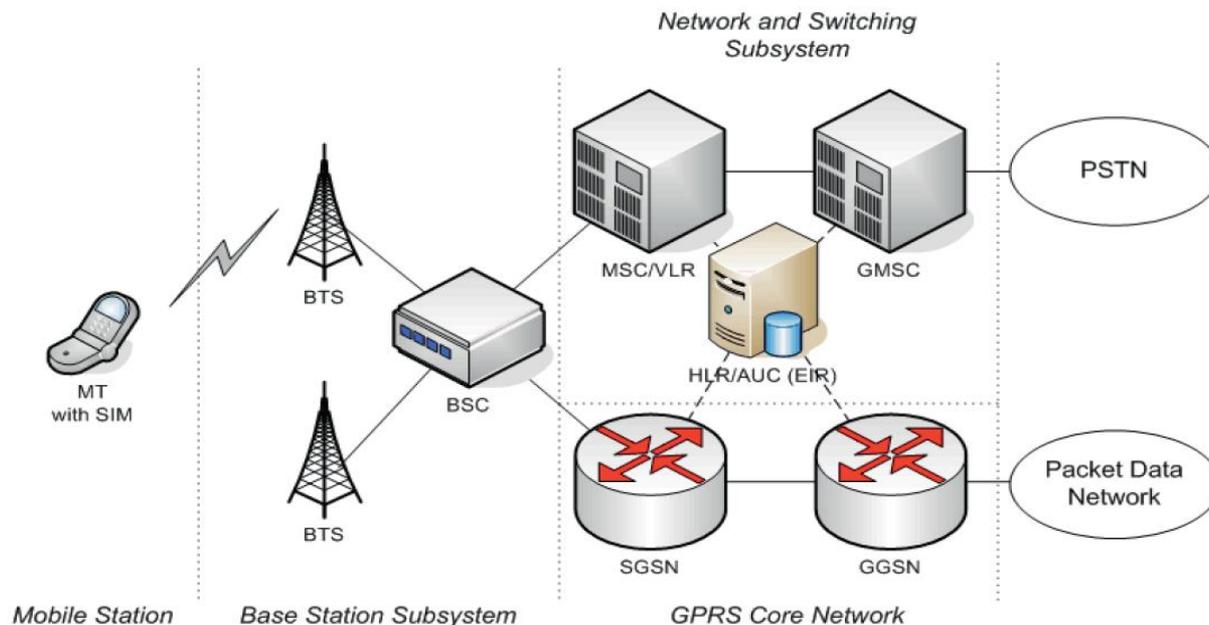
Support for packet switched data was added in Release 97 when GPRS (General Packet Radio Service) arrived (2.5G) . A new subsystem was added to the GPRS Core Network containing two new node types for GPRS Support: SGSN (Serving GPRS Support Node) and GGSN (Gateway GPRS Support Node).