

## Mobile & Cellular Suggestion with solvation

### Short Questions (Each question has 2 marks)

**1. FDMA:** Frequency Division Multiple Access (FDMA) is one of the most common analogue multiple access methods. The frequency band is divided into channels of equal bandwidth so that each conversation is carried on a different frequency. In FDMA method, guard bands are used between the adjacent signal spectra to minimize crosstalk between the channels. A specific frequency band is given to one person, and it will be received by identifying each of the frequency on the receiving end.

**2. TDMA:** Time Division Multiple Access (TDMA) is a digital cellular telephone communication technology. It facilitates many users to share the same frequency without interference. Its technology divides a signal into different timeslots, and increases the data carrying capacity. TDMA is used in digital mobile radio systems. The individual mobile stations cyclically assign a frequency for the exclusive use of a time interval.

**3. GPRS:** General Packet Radio Services (GPRS) is a packet-based wireless communication service that promises data rates from 56 up to 114 Kbps and continuous connection to the Internet for mobile phone and computer users. The higher data rates allow users to take part in video conferences and interact with multimedia Web sites and similar applications using mobile handheld devices as well as notebook computers.

**4. 5G:** 5G is the 5th generation mobile network. It will take a much larger role than previous generations. 5G will elevate the mobile network to not only interconnect people, but also interconnect and control machines, objects, and devices. It will deliver new levels of performance and efficiency that will empower new user experiences and connect new industries. 5G will deliver multi-Gbps peak rates, ultra-low latency, massive capacity, and more uniform user experience. For the latest information on 5G, you should visit our 5G website.

**5. 2G:** Second generation wireless telephony technology (2G) refers to telecom network technologies that were launched on the Global System for Mobile Communications (GSM) standard in 1991 by Radiolinja in Finland. The most notable upgrade of 2G over its predecessor is the digital encryption of telephone conversations, and considerably higher efficiency on the spectrum, which allows for greater penetration level for mobile phones. 2G also introduced mobile data services, beginning with SMS text messaging.

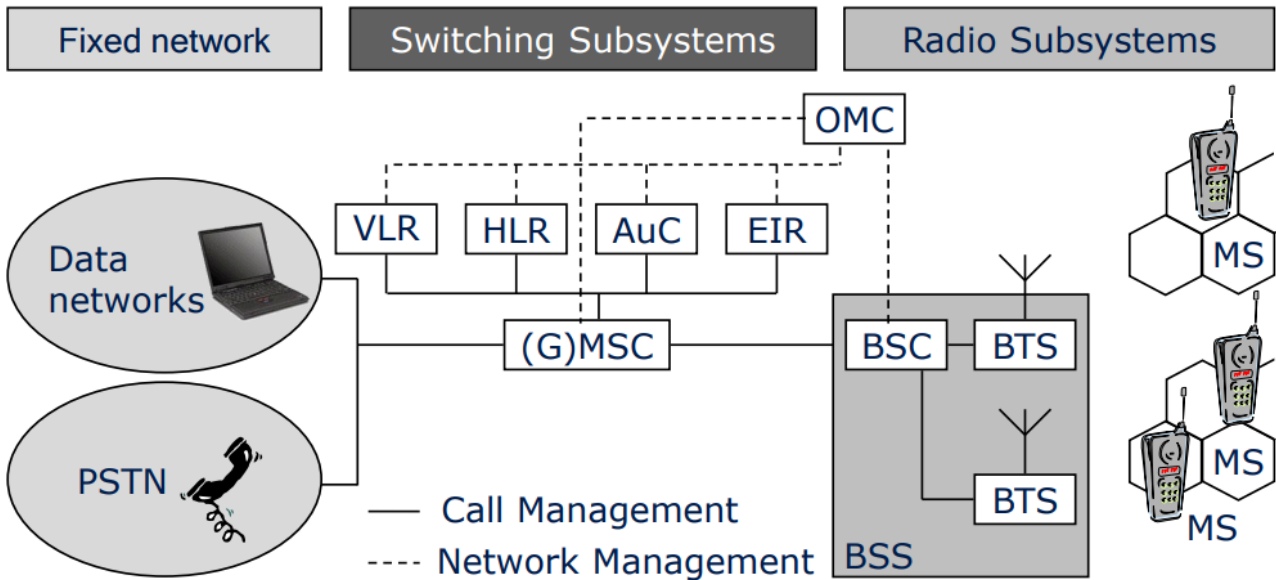
**6. 3G:** 3G is the third generation of wireless technologies. It comes with enhancements over previous wireless technologies, like high-speed transmission, advanced multimedia access, and global roaming. 3G is mostly used with mobile phones and handsets as a means to connect the phone to the internet or other IP networks in order to make voice and video calls, to download and upload data, and to surf the Web.

**7. CDMA:** Code Division Multiple Access (CDMA) is a digital cellular technology used for mobile communication. CDMA is the base on which access methods such as CDMAOne, CDMA2000, and WCDMA are built. CDMA cellular systems are deemed superior to FDMA and TDMA, which is why CDMA plays a critical role in building efficient, robust, and secure radio communication systems.

### Broad Questions (Each question has 8 marks)

**1. Briefly describe GSM structure with appropriate figure.**

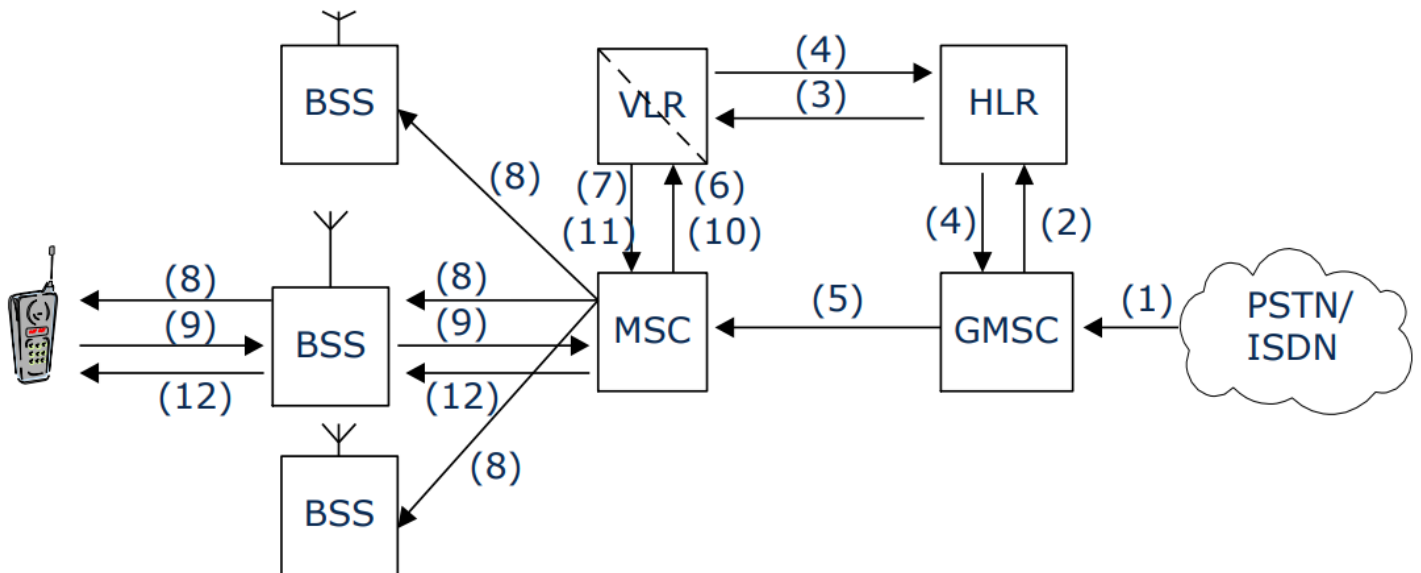
**Answer:** The GSM structure is briefly described below with figure:



AuC	Authentication Center	MS	Mobile Station
BSS	Base Station Subsystem	(G)SMC	(Gateway) Mobile Switching Center
BSC	Base Station Controller	OMC	Operation and Maintenance Center
BTS	Base Transceiver Station	PSTN	Public Switched Telephone Network
EIR	Equipment Identity Register	VLR	Visitor Location Register
HLR	Home Location Register		

**2. Briefly explain GSM incoming call structure with appropriate figure.**

**Answer:**

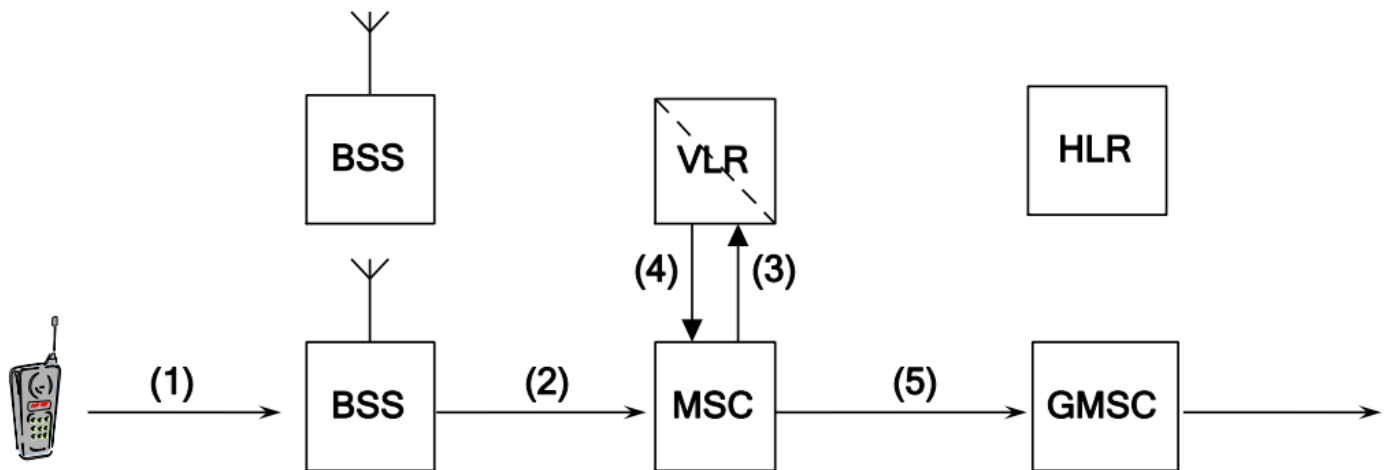


- (1) Call from fixed network was switched via GMSC
- (2) GMSC finds out HLR from phone number
- (3) HLR checks whether participant is authorized for corresponding service and asks for MSRN at the responsible VLR.
- (4) MSRN will be returned to GMSC, can now contact responsible MSC
- (5) GMSC transmits call to current MSC
- (6) Ask for the state of the mobile station

- (7) Information whether end terminal is active
- (8) Call to all cells of the Location Area (LA)
- (9) Answer from end terminal
- (10 - 12) Security check and connection setup

**3. Briefly explain GSM outgoing call structure with appropriate figure.**

**Answer:**



- (1) Connection request (via random access channel, possible collision handling)
- (2) Transfer by BSS
- (3-4) Authorization control
- (5) Switching of the call request to fixed network

**4. Write down the characteristics of HLR & VLR.**

**Answer:** Home Location Register (HLR), stores data of participants which are registered in an HLR-area

**Semi-permanent data:**

- Call number (Mobile Subscriber International ISDN Number) - MSISDN, e.g. +49/171/333 4444 (country, network, number)
- Identity (International Mobile Subscriber Identity) - IMSI: MCC = Mobile Country Code (262 for .de) + MNC = Mobile Network Code (01-T-Mobile, 02-Vodafone, 03-eplus, 07-O2) + MSIN = Mobile Subscriber Identification Number
- Personal data (name, address, mode of payment)
- Service profile (call transfer, roaming-limits etc.)

**Temporary data:**

- MSRN (Mobile Subscriber Roaming Number) (country, network, MSC)
- VLR-address, MSC-address
- Authentication Sets of AuC (RAND (128 Bit), SRES (128 Bit), KC (64Bit))
- Billing data

**Visitor Location Register (VLR):** local database of each MSC with following data:

- IMSI, MSISDN
- Service profile
- Billing and accounting information
- TMSI (Temporary Mobile Subscriber Identity) - pseudonym for data security

- MSRN
- LAI (Location Area Identity)
- MSC-address, HLR-address

**5. Explain the GSM properties.**

**Answer:** The GSM properties are explained below:

- cellular radio network (2nd Generation)
- digital transmission, integrated data communication
- roaming (mobility between different network operators)
- good transmission quality (error detection and - correction)
- scalable (large number of participants possible)
- security mechanisms (authentication, authorization, encryption)
- good resource use (frequency and time division multiplex)
- integration with fixed telephone network
- Standard (ETSI, European Telecommunications Standards Institute)