GSM, GPRS

GLOBAL SYSTEM FOR MOBILE (GSM)

- The GSM is the standard for 2G.
- It is the most successful digital mobile telecommunication system in the world today.
- It is a special second generation (2G) system, replacing the first generation (1G) analog system.
- It is initially deployed in Europe.

GSM - SERVICES

- GSM has defined 3 categories of services.
  - Telephone or tele services
  - Bearer or data services
  - Supplementary services

(i) Teleservices

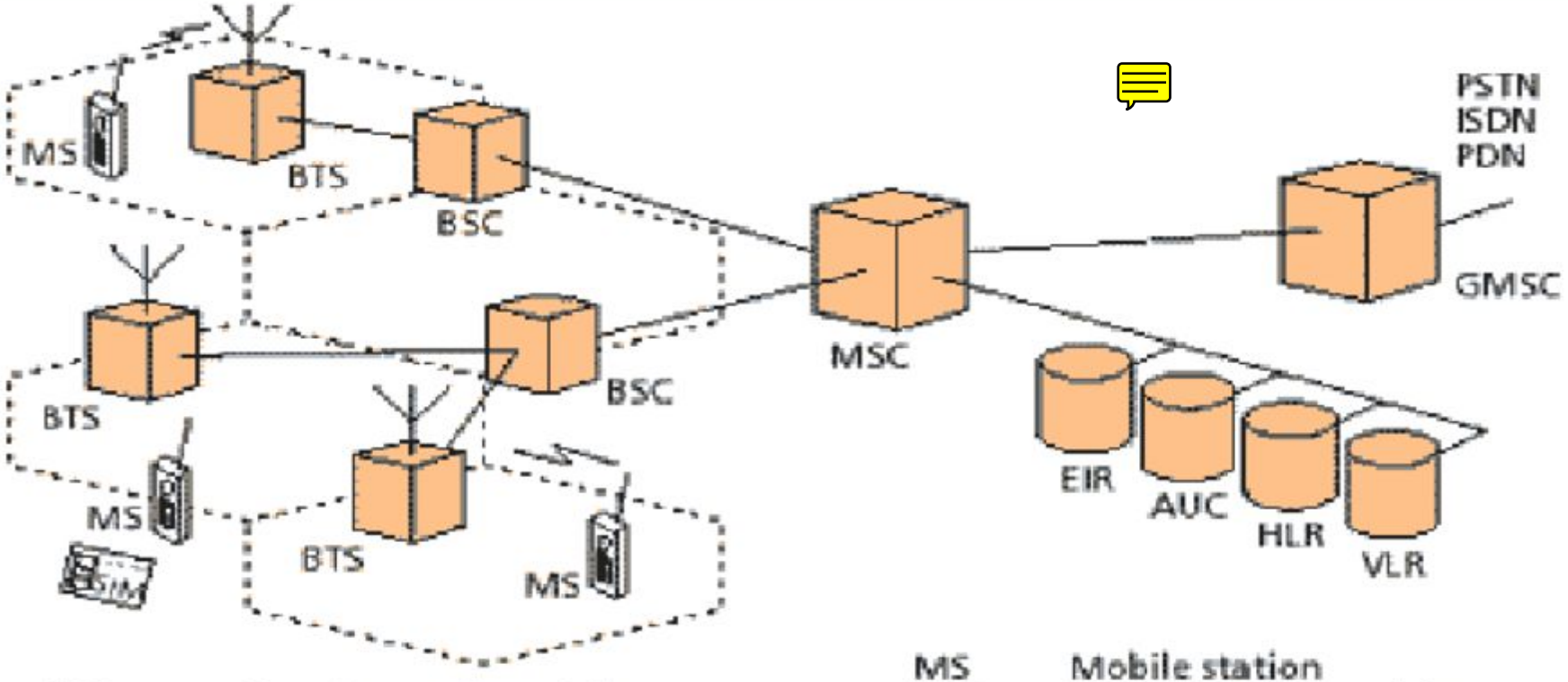
- GSM mainly focuses on voice oriented tele services.
- The primary goal of the GSM is the high quality digital voice transmission.
- Another useful service is the Short message service (SMS) – up to 160 characters.
- The successor of SMS, the Enhanced Message Service (EMS) offers a larger message service (760 characters) , small images and ring tones.
- It also offers Multimedia Message Service (MMS) which is used in transmission of large pictures (GIF, JPG) and short video clips.

(ii) Bearer or Data services

- GSM services provide capabilities to transmit information among user network – interfaces or access points (APs).
- Bearer services permit transparent and non-transparent, synchronous or asynchronous data transmission.
    - Transparent bearer services (GSM provides standard channel coding for the user data only) use the functions of the physical layer to transmit data.
    - Non transparent bearer services use protocols of layers (two – data link layer and three – network layer) to implement error correction and flow control.

(iii) Supplementary services

- These are not the stand alone services. But they are services that supplement a bearer or tele services.
- This digital service includes call diversion or forwarding of ongoing calls, closed user groups and caller identification.
- SMS may be used for safety and advisory application such as broadcast of highway or weather information to all GSM subscribers within reception with in reception range.



BTS	Base transceiver station
BSC	Base station controller
BSS	Base station subsystem (BTS+BSC)
MSC	Mobile switching center
GMSC	Gateway MSC

MS	Mobile station
HLR	Home location register
VLR	Visited location register
EIR	Equiment identity register
AUC	Authentication center

GSM architecture

- The mobile handset is called Mobile Station (MS).
- A cell is formed by the coverage area of a Base Transceiver Station (BTS) and serves the MS in its coverage area. Several BTS together are controlled by one Base Station Controller (BSC).
- The BTS and BSC together form Base Station Subsystem (BSS).
- The combined traffic of the mobile stations in their respective cells is routed through a switch called Mobile Switching Center (MSC).
- Connection originating or terminating from external telephone (PSTN) are handled by a dedicated gateway Gateway Mobile Switching Center (GMSC).

GSM architecture

- In addition, several databases are used for the purpose of call control and network management. These databases are Home Location Register (HLR), Visitor Location Register (VLR), the Authentication Center (AUC), and Equipment Identity Register (EIR).
- HLR stores the permanent (such as user profile) as well as temporary (such as current location) information about all the users registered with the network.
- VLR stores the data about the users who are being serviced currently. It includes the data stored in HLR for faster access as well as the temporary data like location of the user.
- AUC stores the authentication information of the user such as the keys for encryption. The EIR stores stores data about the equipments and can be used to prevent calls from a stolen equipments.
- All the mobile equipments in GSM system are assigned unique id called IMSI (International Mobile Equipment Identity) and is allocated by equipment manufacturer and registered by the service provider. This number is stored in the EIR. The users are identified by the IMSI (International Module Subscriber Identity) which is stored in the Subscriber Identity Module (SIM) of the user. A mobile station can be used only if a valid SIM is inserted into an equipment with valid IMSI.

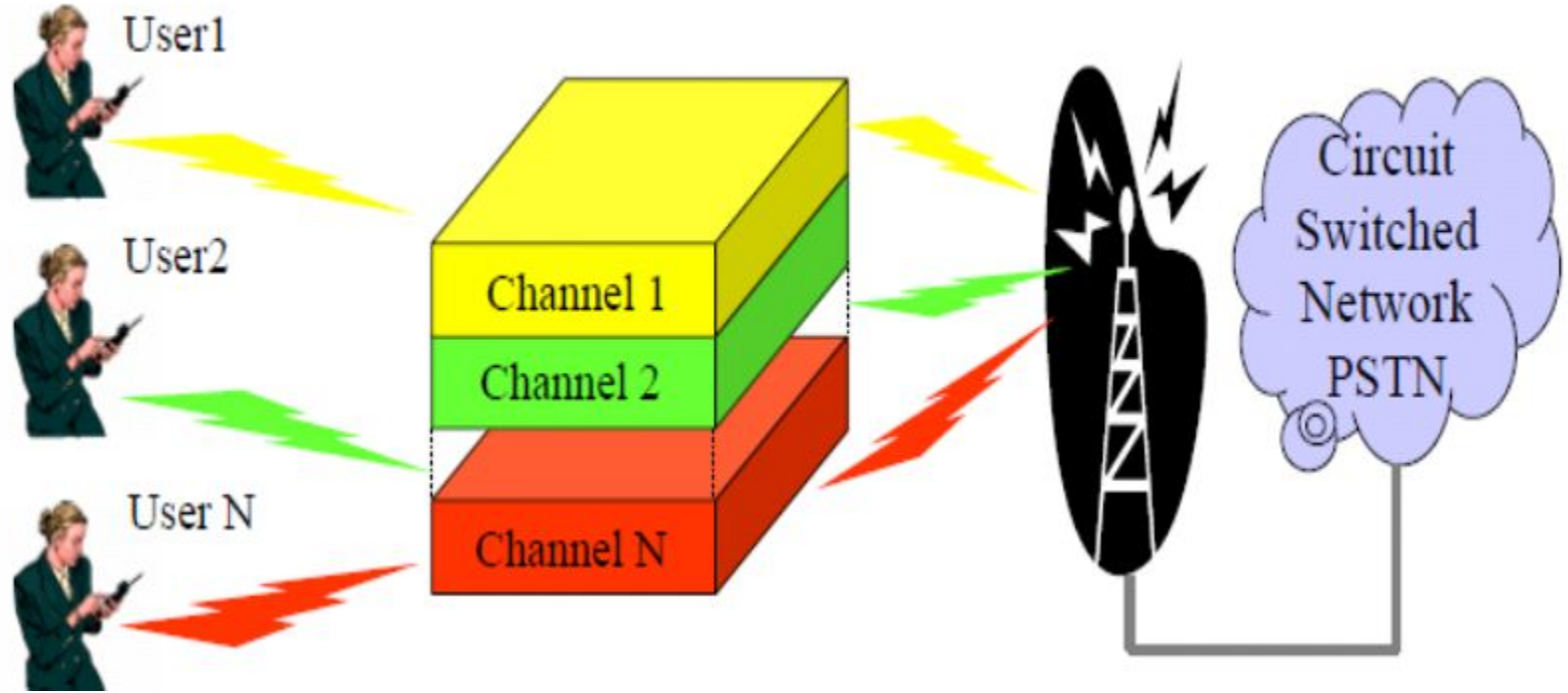
GPRS

- General Packet Radio Service
- Value added service to 2G to connect users to IP (Internet Protocol) -based data networks
- Forms basis of Packet Switched Network
- Data rate up to 115 Kbps with GPRS

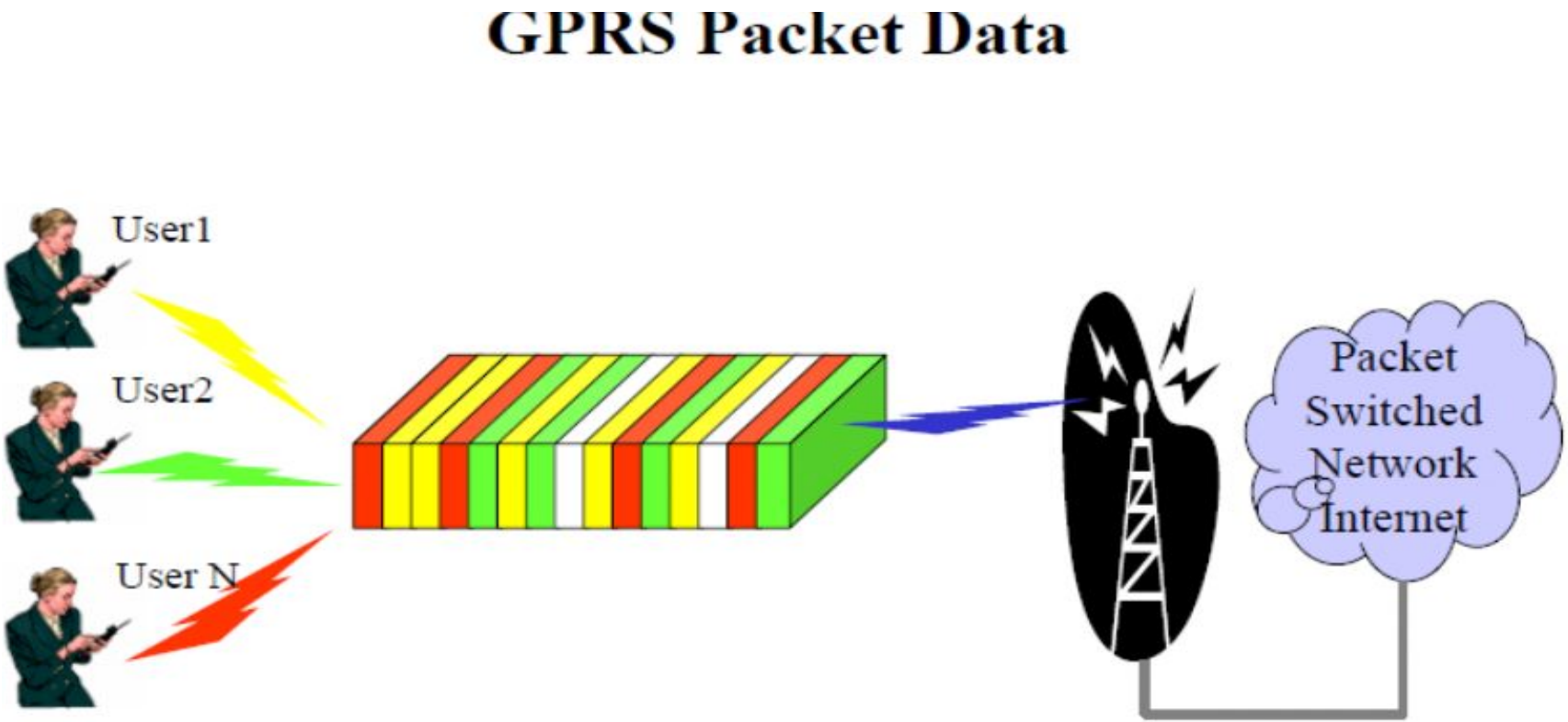
Circuit and Packet Switching

- Circuit Switching
  - Dedicated resources to each user
  - Higher performance and higher cost
- Packet Switching
  - Shares resources with multiple users
  - Lower performance and lower cost
  - Requires MAC (Medium Access Control)
  - Requires memory buffering

Circuit switched network



Packet switched network



GPRS architecture

GPRS integrates with the existing GSM network by adding the following components:

- **Mobile Station (MS)**:
  - The user's device (e.g., a mobile phone, tablet, or laptop with a GPRS-enabled SIM card).
- **Base Station Subsystem (BSS)**:
  - Handles radio communication with the mobile station. It is enhanced with a Packet Control Unit (PCU) for GPRS functionality.
- **Serving GPRS Support Node (SGSN)**:
  - Responsible for delivering data packets to and from the mobile station.
  - Handles mobility management, such as location tracking.
- **Gateway GPRS Support Node (GGSN)**:
  - Acts as a gateway between the GPRS network and external packet data networks like the Internet.
  - Converts GPRS packets into standard data packets for transmission over the external network.
- **Home Location Register (HLR)**:
  - Stores subscriber data and GPRS-specific information such as access point names (APNs) and Quality of Service (QoS) profiles.

Advantages

- **Efficient Use of Resources**: Optimizes network capacity by sharing available bandwidth.
- **Flexible Billing**: Charges based on data usage rather than connection time.
- **Faster Data Transfer**: Provides quicker access compared to traditional GSM networks.

Limitations

- **Limited Speed**: Compared to 3G and 4G, GPRS speeds are relatively low.
- **Latency**: Higher latency than newer technologies, making it unsuitable for real-time applications.
- **Network Dependency**: Performance depends on the availability and quality of the GSM network.

GSM vs GPRS

	GSM	GPRS
Data Rates	9.6 Kbps	14.4 to 115.2 Kbps
Modulation Technique	GMSK	GMSK
Billing	Duration of connection	Amount of data transferred
Type of Connection	Circuit – Switched Technology	Packet - Switched Technology