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A Review on Call Processing and Understanding of Signal in GSM Nerwork

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I. INTRODUCTION

The main task of telecommunication network is call Processing. Call Processing means how a call is connected between ms-1 to ms-2 in GSM network is known as call Processing. This includes identifying incoming calls, establishing a communication path for the duration of the connection, and disconnecting the call after the conversation has ended.

The first part to mobile call processing is initialization. It's what happens when you first turn on your phone. You get a connection to a nearby cell site, then the cellular network checks your account. If you have a valid telephone number and your account is good then your call proceeds. First of all a connection is to be established with nearby BTS. It is not possible to make a call unless your mobile has a link to a cell site.

The main elements of cellular network are the base stations, a switching network, land lines, and the mobile users. In a simple cellular system, there is only one base station per cell. It consists of a transmitter/receiver, which communicates directly with the users in its cell. Each base station is connected via land lines to a central switching network. The switching network makes important decisions such as channel allocation and cell hand off.

II. What is GSM

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz It is estimated that many countries outside of Europe will join the GSM partnership.

Throughout the evolution of cellular telecommunications, various systems have been developed without the benefit of standardized specifications. This presented many problems directly related to compatibility, especially with the development of digital radio technology. The GSM standard is intended to address these problems.

III. GSM Network

GSM provides recommendations, not requirements. The GSM specifications define the functions and interface requirements in detail but do not address the hardware. The reason for this is to limit the designers as little as possible but still to make it possible for the operators to buy equipment from different suppliers. The GSM network is divided into three major systems: the switching system (SS),

the base station system (BSS), and the operation and support system (OSS).The figure is shown below.

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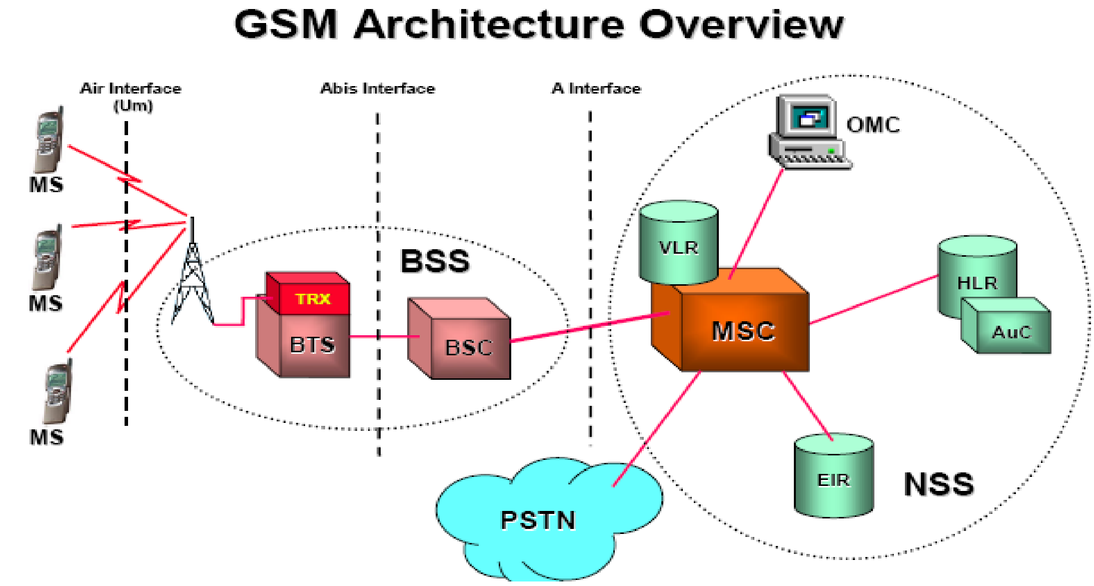

IV.THE SWITCHING SYSTEM

The switching system (SS) is responsible for performing call processing and subscriber-related functions. The switching system includes the following functional units:

- **Home Location Register (HLR)**—

The HLR is a database used for storage and management of subscriptions. The HLR is considered the most important database, as it stores permanent data about subscribers, including a subscriber's service profile, location information, and activity status. When an individual buys a subscription from one of the PCS operators, he or she is registered in the HLR of that operator.

- **Mobile Services Switching Center (MSC)**—

The MSC performs the telephony switching functions of the system. It controls calls to and from other telephone and data systems. It also performs such functions as toll ticketing, network interfacing, common channel signaling, and others.

- **Visitor Location Register (VLR)**—

The VLR is a database that contains temporary information about subscribers that is needed by the MSC in order to service visiting subscribers. The VLR is always integrated with the MSC. When a mobile station roams into a new MSC area, the VLR connected to that MSC will request data about the mobile station from the HLR. Later, if the mobile station makes a call, the VLR will have the information needed for call setup without having to interrogate the HLR each time.

- **Authentication Center (AUC)**—

A unit called the AUC provides authentication and encryption parameters that verify the user's identity and ensure the confidentiality of each call. The AUC protects network operators from different types of fraud found in today's cellular world.

- **Equipment Identity Register (EIR)**—

The EIR is a database that contains information about the identity of mobile equipment that prevents calls from stolen, unauthorized, or defective mobile stations. The AUC and EIR are implemented as stand-alone nodes or as a combined AUC/EIR node.

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Mobile Station

- Mobile station communicates across Um interface (air interface) with base station transceiver in same cell as mobile unit
- Mobile equipment (ME) – physical terminal, such as a telephone or PDA

o ME includes radio transceiver, digital signal processors and subscriber identity module (SIM)

- GSM subscriber units are generic until SIM is inserted SIMs roam, not necessarily the subscriber devices

V. THE BASE STATION SYSTEM (BSS)

All radio-related functions are performed in the BSS,which consists of base station controllers (BSCs) and the base transceiver stations (BTSs).

- **BSC**—The BSC provides all the control functions and physical links between the MSC and BTS. It is a high-capacity switch that provides functions such as handover, cell configuration data, and control of radio frequency (RF) power levels in base transceiver stations. A number of BSCs are served by an MSC.
- **BTS**—The BTS handles the radio interface to the mobile station. The BTS is the radio equipment (transceivers and antennas) needed to service each cell in the network. A group of BTSs are controlled by a BSC.

VI. GSM SPECIFICATIONS-1

- RF Spectrum
- **GSM 900**

  Mobile to BTS (uplink): 890-915 MHz

  BTS to Mobile(downlink):935-960 MHz

Bandwidth : 2* 25 MHz

- **GSM 1800**

  Mobile to BTS (uplink): 1710-1785 MHz

  BTS to Mobile(downlink) 1805-1880 MHz

Bandwidth : 2* 75 MHz

VII. GSM SPECIFICATION-II:-

- Carrier Separation : 200 KHz
- Duplex Distance : 45 MHz
- No. of RF carriers : 124
- Access Method : TDMA/FDMA
- Modulation Method : GMSK
- Modulation data rate : 270.833 Kbps
- 890 to 915mhz mobile to BTS – UPLINK Frequency
- 935 to 960mhz BTS to mobile – DOWNLINK Frequency

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VIII. CELLS

Cells mean Area covered by the BTS which transmits and receives signals on Radio Channels.

Cell provides the complete coverage for the designed area. Each cell is allocated a number of Radio Channels. The MS and BTS communicate over these radio channels.

Cell is identified by a number called CGI –Cell Global Identification.

IX. TYPES OF CELLS

Different density of population gives the need for different types of cells.

- Macro Cells
- Micro Cells
- Selective Cells
- Umbrella Cells

Macro cell

- Large cells for remotely and scarcely populated area.

Micro Cell

- Cells used in densely populated areas.
- Area is divided into smaller cells hence number of channels increased.
- Capacity is also increased.
- Power level is decreased, thus reducing interference.

Selective Cell

- Used to define a cell with full coverage.
- Cells with particular coverage and shape such as a tunnel are called selective cells.

Umbrella Cell

- An umbrella cell covers several small micro cells
- Power level of Umbrella Cell is kept high compared to micro cells forming the umbrella cell.
- Umbrella cell thus handles high speed mobiles reducing internal handovers.

X. CELL SIZE AND CAPACITY

- Cell size determines number of cells available to cover geographic area and (with frequency reuse) the total capacity available to all users.
- Capacity within cell limited by available bandwidth and operational requirements.
- Each network operator has to size cells to handle expected traffic demand.

XI. GSM VOICE & CHANNEL CODING

In order to send our voice across a radio network, we have to turn our voice into a digital signal. GSM uses a method called RPE-LPC (Regular Pulse Excited - Linear Predictive Coder with a Long Term Predictor Loop) to turn our analog voice into a compressed digital equivalent. Once we have a digital signal we have to add some

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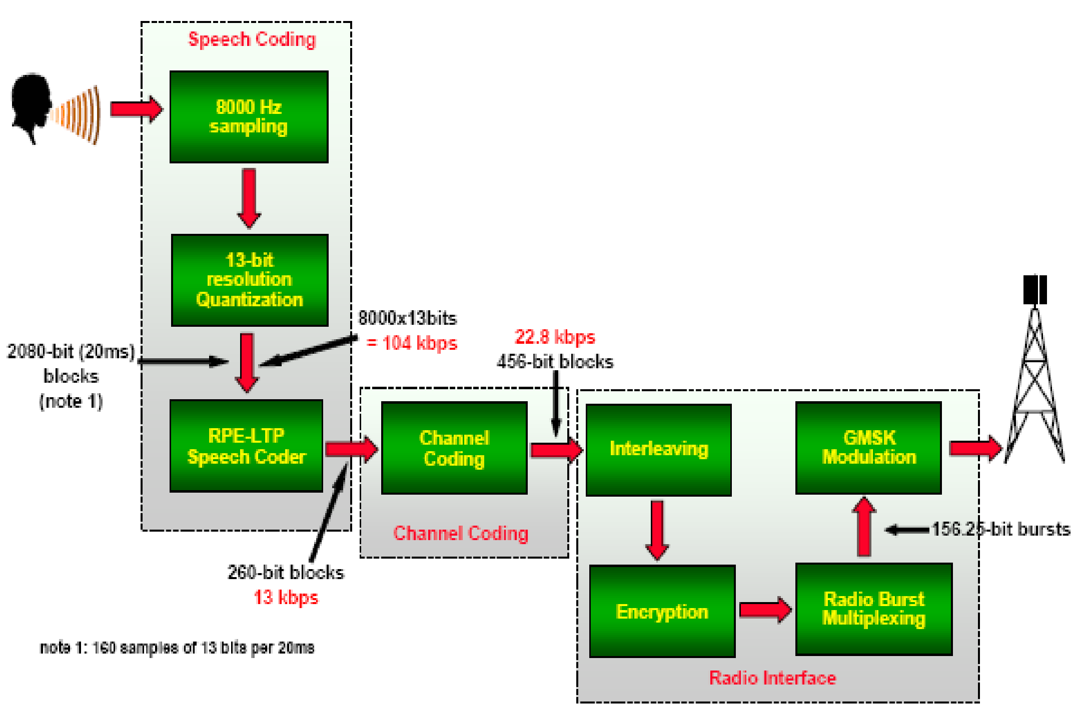
sort of redundancy so that we can recover from errors when we trams our digital voice over the radio channel. GSM uses a convolution codes to encode digital speech representations.

Here we will consider two forms of coding techniques used within the GSM system.

Firstly the process used to convert human speech into a digital equivalent and secondly the coding processes for compressing and protecting the data for transmission over the air interface.

XII. GSM VOICE & CHANNEL CODING SEQUENCE



XIII. SPEECH CODING

• GSM transmits using digital modulation - speech must be Converted to binary digits Coder and decoder must work to The same standard Simplest coding scheme is Pulse Code

Modulation (PCM).

XIV. CONTINUE

- The transmission of speech is one of the most important services of a mobile cellular system.
- The GSM speech codec, which will transform the analog signal(voice) into a digital representation, has to meet the following criteria's.
- A good speech quality, at least as good as the one obtained with previous cellular systems.
- To reduce the redundancy in the sounds of the voice. This reduction is essential due to the limited capacity of transmission of a radio channel.
- The speech codec must not be very complex because complexity is equivalent to high costs.
- The final choice for the GSM speech codec is a codec named RPE-LTP (Regular Pulse Excitation Long-Term Prediction).

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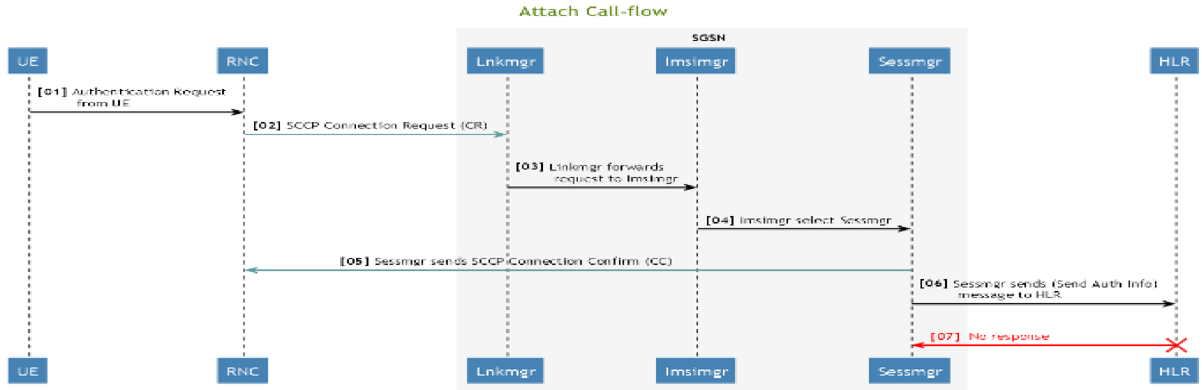
- This codec uses the information from previous samples (this information does not change very quickly) in order to predict the current sample.
- The speech signal is divided into blocks of 20 ms. These blocks are then passed to the speech codec, which has a rate of 13 kbps, in order to obtain blocks of 260 bits.

XV. CHANNEL CODING

- Channel coding adds redundancy bits to the original information in order to detect and correct, if possible, errors occurred during the transmission.
- The channel coding is performed using two codes: a block code and a convolution code.
- The block code receives an input block of 240 bits and adds four zero tail bits at the end of the input block. The output of the block code is consequently a block of 244 bits.
- A convolution code adds redundancy bits in order to protect the information. A convolution encoder contains memory. This property differentiates a convolution code from a block code.

Call flow continuing…..

The base then sends this assignment to the user and conversation may begin, When the conversation ends, the user terminal sends a “disconnect” signal to its base station, which in turn relays the signal to the switching network.



Description of call flow :

01 - Attach request is received from UE by RNC

02 - RNC forwards the request to SGSN using SCCP Connection Request (CR) carrying RANAP "Initial UE Message" message.

03 - In SGSN the Link Manager (linkmgr) forwards this request to IMSI Manager (Imsimgr)

04 - IMSI Manager selects a Session Manager (sessmgr) to handle this subscriber.

05 - Session Manager sends the SCCP Connection Confirm (CC) message to RNC. The SCCP CC contains the local reference generated by sessmgr.

06 - Session Manager sends "Send Authentication Info Request" message to HLR with TCAP ID generated by Session Manager. By default it uses MAPv3 and falls back to MAPv2 in case v3 fails. If no MM context for UE exists on the SGSN, then authentication is mandatory. If P-TMSI allocation is going to be done, and if ciphering is supported by the network, ciphering mode shall be set. The SGSN queries HLR for authentication “triplets” (GPRS) or “quintuplets” (UMTS) for the subscriber's IMSI.

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The network can then free the previously assigned channel and can allocate it to another user. If the user moves to another cell, then the problem of hand off must be considered. For example, if a user starts a conversation in cell **1** and then moves toward cell 2, then both base stations in cells 1 and **2** constantly monitor the user's signal strength. This data is then send to the switching network. **It** should be

noted that while bases other than of cells 1 and **2** are also monitoring the users signal, the user's signal in relation to calls in cells 1 and 2 should be the strongest.

Thus, when tell 2 receive a stronger signal, handoff begins. Base in cell 2 alerts the network and if a free channel is available the new channel is allocated to the user.

XIV. CONCLUSION

This paper presents a call processing model for wireless network. **A** call from a mobile user is set up through a base station and a number of switches. A switch has the input queue for the source and the output queue. The packets are held in the input queue if the output queue in the switch is **full.** The input queue is a buffer that holds the packets if the required Bandwidth exceeds the available bandwidth. The switch design allows for collision free packet transfer between the input and the output queue. **A** variable buffer is employed based upon the protocol carried, with a priority technique used to service time sensitive protocols. **A** multiplexing mechanism is used to allow other protocols to entire the queue during time-outs. Wireless communication can cause congestion in High-spaced switching network depending on the volume or calls, their origination and the network architecture.

In congested areas where wireless services are extensively used, the switching network can become congested. In addition, the quality of wireless communication can decrease because of the frequency range that allows for limited number of calls made within the cell. The call processing model allows for evaluation of those limitations and for choosing the best possible solution.

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