GSM Call Flow (GSM Originating Call)

Cell		Mobile Network		Fixed Network	EventStudio System Designer 4.0
Mobile Station		Base Stations	NSS	PSTN	
User	Mobile	BSS	MSC VLR	PSTN	13-Sep-08 21:41 (Page 1)

LEG: GSM Mobile Originated Call

This scenario describes the call setup for a GSM originating call. A mobile user calling a land line subscriber is covered here.

Dial the called person's number

The user keys in the phone number for the landline subscriber and ..

Send Button

.. presses the Send button

Begin RR Connection Establishment

Call related information needs to be transported from the mobile phone to the Mobile Switching Center (MSC). This requires the establishment of a Radio Resource (RR) connection to MSC. The first phase of the call setup just sets up this RR connection.

RR CHANNEL REQUEST

RACH

RR connection establishment is triggered by sending the Channel Request message. This message requests the Base Station System (BSS) for allocation for radio resources for the RR connection setup. The mobile now waits for an assignment on the Access Grant Channel (AGCH). At this point the mobile is listening to the AGCH for a reply.

Note: The RR CHANNEL REQUEST is sent on a Random Access Channel (RACH). This is a slotted aloha channel that can be used at random, without any coordination between the mobiles. Any mobile can transmit on this channel whenever it wishes. If two mobiles transmit on the channel at the same time, their messages will be lost in a collision. The mobiles will detect the collision via a timeout and retransmit the message after a random back off.

allocate
TCH

The BSS allocates a Traffic Channel (TCH) to the mobile. The TCH allocation assigns a specifies a frequency and a timeslot on that frequency. After the mobile receives this message, the mobile shall only use the specified resources for communication with the mobile network.

RR IMMEDIATE ASSIGNMENT

AGCH, Radio_Resource = (TCH, Frequency, Timeslot), Time Correction, Frequency Correction

The BSS transmits the radio resource assignment to the Mobile via the AGCH channel. The message also contains the time and frequency corrections. The time corrections allow the mobile to time it's transmissions so that they reach the BSS only in the specified slot. The frequency corrections correct for the Doppler shift caused by the mobile's motion.

Apply the time and frequency corrections

Adjust the frequency and timing based on the advice from the BSS. This step is required so that transmissions from the mobile reach the base station at the precise time and with the correct frequency.

Tune to the frequency and timeslot

The mobile detunes from the AGCH and tunes to the specified radio channel.

RR SABM + MM CM SERVICE REQUEST

TCH, SAPI = 0

This is the first message that is sent after tuning to the channel. The Mobile initiates a LAPm connection with the BSC by sending a Set Asynchronous Balanced Mode (SABM) message. The service request message meant for the MSC is also sent in this message.

RR UA

TCH, SAPI = 0

The BSS replies with Unnumbered Acknowledge (UA) to complete the LAPm setup handshake

SCCP CONNECTION REQUEST + MM CM SERVICE REQUEST

SS7

The BSS receives the CM Service Request message from the mobile and forms a "BSSMAP COMPLETE LAYER 3 INFORMATION". The BSS then piggy backs the message on the SCCP connection request message.

LEG: Skip Authentication Procedure

Check subscriber authentication

MSC checks if the subscriber has been authenticated. In this case, the subscriber has already been authenticated, so the authentication procedure is skipped.

Enable Ciphering

BSSMAP CIPHER MODE COMMAND

Since the subscriber has been successfully authenticated, the MSC initiates ciphering of the data being sent on the channel. The channel is ciphered so as so protect the call from eavesdropping.

Expect ciphered data from the mobile

Ciphering on the radio link is enabled in three steps. As a first step, the BSS starts expecting ciphered data from the mobile but continues to send data in clear. Since the mobile has not been informed about the ciphering, all data received from the mobile will be in error.

RR CIPHERING MODE COMMAND

mode = CLEAR

The BSS sends the CIPHERING MODE COMMAND to the mobile. The mobile will be able to receive this message as the transmission from the BSS is still in clear.

Enable ciphering for received and transmitted data

As a second step, the Mobile receives the message and enables ciphering in transmit and receive directions. This action will result in all BSS data being received in error. (The BSS is still transmitting data in clear.)

RR CIPHERING MODE COMPLETE

mode = CIPHERED

Ciphering has already been enabled, so this message is transmitted with ciphering. The BSS will receive this message as it is already expecting ciphered data in the receive direction.

Enable ciphering of data transmitted to the mobile

The third and final step in the ciphering handshake. The BSS enables the ciphering in transmit direction. From this point on ciphering is enabled in both directions.

BSSMAP CIPHER MODE COMPLETE

BSS replies back to the MSC, indicating that ciphering has been successfully enabled.

RR Connection Establishment Completed

At this point a connection has been setup between the Mobile and the MSC. From this point onward, the BSS is just acting as a conduit for transporting the signaling messages between the Mobile and the MSC.

Call Setup

CC SETUP

Dialed Digits

The Mobile sends the setup message to establish a voice call. The message contains the dialed digits and other information needed for call establishment.

CC CALL PROCEEDING

The mobile is informed that the call setup is in progress.

Connecting...

At this point, the mobile phone displays a message on the screen to indicate that call setup is being attempted.

Mode Modify

allocate
Voice circuit towards BSS

The MSC allocates a voice circuit on one the digital trunks between the MSC and the BSS.

BSSMAP ASSIGNMENT REQUEST Voice circuit	MSC informs the BSS about the allocated voice circuit. The call is also switched from signaling to voice.
RR CHANNEL MODE MODIFY	The BSS notifies the Mobile about the changeover to voice mode.
RR CHANNEL MODE MODIFY ACKNOWLEDGE	Mobile acknowledges.
BSSMAP ASSIGNMENT COMPLETE	The BSS responds back to the MSC.
ISUP INITIAL ADDRESS MESSAGE SS7, Dialed Digits	The MSC routes the call and sends the call towards the called subscriber
ISUP ADDRESS COMPLETE MESSAGE SS7	The PSTN indicates to the MSC that it has received all the digits and the called subscriber is being rung.
CC ALERTING	The MSC informs the mobile that the called subscriber is being alerted via a ring
Alerting Tone	
ISUP ANSWER SS7	The called subscriber answers the call.
CC CONNECT	The MSC informs the mobile that the call has been answered.
CC CONNECT ACKNOWLEDGE	Acknowledge the recipt of CC CONNECT.
Connected	Display that the call has been connected.

Conversation

Speech	The call has entered the conversation phase. The speech path has been setup between the mobile subscriber and the land-line subscriber.

Call Release

	LEG: Mobile initiates call release
End Button	The mobile subscriber hits End to clear the call.
CC DISCONNECT	The mobile sends the disconnect message to the MSC.
ISUP RELEASE SS7	The MSC initiates release on the PSTN side.
Disconnect Voice Path	The MSC disconnects the voice path and also releases the voice circuit between the BSS and the MSC.
free Voice circuit towards BSS	
CC RELEASE	The MSC informs the Mobile that it has initiated call release
ISUP RELEASED SS7	The MSC informs the PSTN that the call release has been completed.
ISUP RELEASE COMPLETE SS7	The PSTN informs that call release has been completed at its end.
CC RELEASE COMPLETE	Mobile indicates that the call has been released.

RR Connection Release

BSSMAP CLEAR COMMAND	Call release has been completed, now the RR connection is released by the MSC.
RR CHANNEL RELEASE	The BSS initiates RR release with the mobile.
BSSMAP CLEAR COMPLETE	The BSS informs the the MSC that the RR connection has been released.
RR DISC	The mobile sends a disconnect message to release the LAPm connection.
RR UA	The BSS replies with an Unnumbered Acknowledge message.
free TCH	The BSS releases the TCH channel.
Call Released Indication	Mobile goes back to the default display to indicate that call has been completely released.