



2G, 3G Network Planning and Optimization...

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Archives

▼ 2009 (56)

► Октябрь (15)

▼ Сентябрь (41)

- 3.8 Network Capacity Comparison For the comparis...
- 3.7 Multiple Reuse Pattern Technology3.7.1 Basic...
- 3.6 Concentric Cell Technology 3.6.1 Concept I...
- 3.5 Aggressive Frequency Reuse Technology 3.5.1 ...
- 3.4 Normal Frequency Reuse Technology 3.4.1 C...
- 3.3 Frequency Planning Principle Generally, when ...
- 3.2 Frequency Division and CI Requirement 3.2.1 ...
- 3 GSM Frequency Planning 3.1 Overview Frequency ...
- 2.13 Conclusion Network planning is the foundatio...
- 2.12 Repeater Planning 2.12.1 Application Backg...
- 2.11 Tunnel Coverage 2.11.1 Characteristic of T...
- 2.10 Design of Indoor Coverage System2.10.1 Ch...
- 2.9 Dual-Band Network Design 2.9.1 Necessity for...
- 2.8 Location Area Design 2.8.1 Definition of Loc...
- 2.7 Design of Base Station Address 2.7.1 Address d...
- 2.6 Base Station Number Decision After traffic an...
- 2.5 Traffic Analysis 2.5.1 Traffic Prediction an...
- 2.4 Network Structure Analysis When considering t...
- 2.3 Coverage Analysis 2.3.1 Area Division I. Typ...
- 2.2 Planning Foundation 2.2.1 Coverage and Capacit...
- 2 GSM Radio Network Planning 2.1 Overview The de...
- 1.17 CBS Cell Broadcast Service (CBS) is similar ...
- 1.16 Call Re-Establishment 1.16.1 Introduction ...
- 1.15 HOAs a key technology in the cellular mobil...
- 1.14 MS Originated Call Flow 1.14.1 Enquiry Afte...
- 1.13 MS Originating Call Flow The MS needs to set ...
- 1.12 Location Update In GSM, the paging informati...
- 1.11 Authentication and Encryption GSM takes lots...
- 1.10 Immediate Assignment Procedure The purpose o...
- 1.9 Power Control 1.9.1 Power Control Overview P...
- 1.8 Discontinuous Reception and Discontinuous Tra...
- 1.7 Frequency Hopping With the ever growing traff...
- 1.6 Cell Selection and Re-Selection 1.6.1 Cell S...
- 1.5 System Information System information is sent ...
- 1.4 Timing advance Signal transmission has a dela...
- 1.3 Data Transmission Radio channel has totally d...
- 1.2 Multiple Access Technology and Logical Channel...
- 1 GSM Principles and Call Flow 1.1 GSM Frequency ...
- Radio Network Planning Optimization The objective ...
- History of GSM 1 GSM Development Mobile telecomm...

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1.13 MS Originating Call Flow

The MS needs to set up a main signaling link to connect to MSC first, and then initiates the authentication, encryption, and TMSI reassignment flow.

1.13.1 Called Number Analysis

After the authentication, encryption, and TMSI reassignment flow are over, the MS starts the call setup flow.

First, the MS sends a SETUP message to the network side. This message contains called number and the required services. The MSC implements the call proceeding according to the message.

When receive the SETUP message, the MSC sends the outgoing call message SEND_INFO_FOR_O/C_CALL to the VLR. After receive the outgoing call message, the VLR analyzes the items such as called number, the calling party capability, and network resources capability according to the user information obtained from the HLR during the location updating process, to check whether to accept this call request. If a certain item cannot be passed, the VLR sends the RELEASE COMPLETE message to the MS. The call fails. The MS then proceeds to release the bottom layer connection and switches to the idle state. If the above items can be passed, the VLR sends the COMPLETE_CALL message to the MSC. After receive this message, the MSC sends the CALL PROCEEDING message to the MS. It means that the call request is accepted and the call is set up.

1.13.2 Voice Channel Assignment (Follow-up Assignment)

After send the CALL PROCEEDING message to the MS, the MSC activates the follow-up assignment according to the service request. That is, assign the TCH voice channel to the user. At this time, the MSC sends the ASSIGNMENT REQUEST message to the BSC. This message contains the information such as the requested channel type to request the BSC to assign the TCH voice channel for the call.

After receive the channel request from the MSC, the BSC sends the Channel Activation for TCH message to the BTS to activate corresponding terrestrial resources and start a timer at the same time if the TCH channel resources are available. If the BTS has prepared the resources such as circuit, the BTS sends the CHANNELACTIVATIONACK message to the BSC. If the BSC has no available resources to assign, it sends the RESOURCE FAILURE message to the MSC. But if the system allows queuing, the BSC sends the QUEUING INDICATION message to the MSC and places the assignment request in the queue and starts the timer T11. If the T11 times out, the BSC sends the CLEAR REQUEST message to the MSC.

The immediate assignment request, intra-BSC handover, and inter-BSC handover do not support queuing. Only the TCH resource request (that is, the assignment request and intra-cell handover) allows queuing. The TCH resource requests in the queue are assigned with relevant channels in the sequence of their priorities. In the length of the queue reaches its threshold or the timer times out, the request is rejected.

When the BSC receives the CHANNELACTIVATIONACK message from the BTS, the BSC puts the physical information of the channel provided by the BTS in the ASSIGNMENT COMMAND message (this message contains the information such as channel type, voice/data indication, channel rate, voice decoding algorithm and transparent transmission indicator, assignment priority and CIC). The ASSIGNMENT COMMAND message is sent to the MS through the SDCCH channel.

After receive the ASSIGNMENT COMMAND message from the BTS, the MS adjusts the transceiver configuration to the TCH channel and then sends the SABM message to the BTS through the FACCH channel in the way of stolen frame. After the BTS receives the SABM message, the BTS sends the ESTABLISH INDICATION message to the BSC and then sends an Unnumbered Acknowledge (UA) to the MS, just as the initial signaling channel assignment does.

After receive the UA, the MS sends the ASSIGNMENT COMPLETE message to the BTS through the FACCH channel. If the MS fails to identify the assignment information and fails to occupy the specified channel due to the radio interface failure, radio interface message failure or interference, or hardware problems, the MS returns to the original channel and sends the ASSIGNMENT FAILURE to the BTS. If the MS does not receive the ASSIGNMENT COMMAND sent from BTS or the BTS does not receive the response message sent from MS due to interference or other causes, the system starts the corresponding timers (such as T3103 or T3107) and when the timer times out, the channel is released. When receive the ASSIGNMENT COMPLETE message, the BSC sends the ASSIGNMENT COMPLETE message to the MSC. At the same time, it also sends the RF CHANNEL RELEASE message to the BTS to release the occupied SDCCH signaling channel. When the BTS releases the signaling channel, it sends the RF CHANNEL RELEASE ACK message to the BSC. After the BSC receive the message, it considers that the signaling channel is in idle state and can be assigned to other channel requests.

For different purposes, the GSM has three different channel assignment flows. They are initial channel assignment, follow-up channel assignment, and handover channel assignment.

Initial channel assignment: is mandatory to establish the link transmission between the MS and the network. For example, process the location updating request.

During the establishment of the signaling transmission, if the TCH channel is assigned preferably, this assignment is called very early assignment (VEA). After the MSC sends the ASSIGNMENT REQUEST message, the BSC does not apply for new channel but initiate the Mode_Modify flow. After the Mode_Modify is complete, the BSC reports the ASSIGNMENT COMPLETE message to the MSC. If the SDCCH channel is assigned first, and the TCH channel is assigned when it is needed, and then ASSIGNMENT REQUEST message from MSC is sent before the Alerting message, this assignment is called early assignment (EA).

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03 ДЕНЬ	724 195
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Постоянные читатели

If the SDCCH channel is assigned first and the TCH is assigned after the called party sends the CONNECT message, Generally, it adopts the EA mode.

If the EA mode is used in the initial assignment, when no SDCCH is available, assign the TCH channel for the channel request directly. The TCH channel replaces the SDCCH channel to send the signaling message. Please note that using the TCH channel to transmit the signaling wastes the resources a lot because one TCH channel equals eight SDCCH channels. When this situation is quite serious, add more SDCCH to meet the requirement in time.

Follow-up channel assignment

After the signaling channel finishes the authentication and encryption process, if there is still voice or data request, the follow-up channel assignment is triggered to assign a TCH channel.

Handover channel assignment

This assignment is used to apply for channels due to handover during the call process. The system judges whether the handover occurs in the SDCCH or in the TCH to assign corresponding channels. The handover flow and the assignment flow in the cell are the same. The only difference is that the message names are different. Similar to the immediate assignment flow, in the MS assignment flow, the timer T3107 starts when the BSC sends the ASSIGNMENT COMMAND message to the BTS. After the BSC receives the ASSIGNMENT COMPLETE message from the BTS, the timer T3107 resets. Generally, the timeout of the timer is caused by the bad radio coverage. When the timer times out, the MS is considered disconnected with the network and the resources are released for other MSs. Based on the statistics, the channel assignment is generally complete within two seconds. If the BSC does not receive the ASSIGNMENT COMPLETE message within two seconds, the assignment fails. But sometime, the network quality is bad, some messages needs to be sent several times, in this case, the assignment can be extended to five seconds. Generally, if the traffic load of the cell is heavy, set the timer as 2 seconds to 5 seconds. If not heavy, set the timer as 10 seconds.

1.13.3 Call Connection

After receiving the ASSIGNMENT COMPLETE message from the BSC, the MSC sends the Initial Address Message (IAM) that includes the information used to establish the route to the called network. The MSC will receive the call setup report soon. If succeeds, the MSC receives an ADDRESS COMPLETE message (ACM); if fails because of certain reason (such as busy line or congestion), the MSC receives a RELESASE message from the called end.

If MSC receives the ACM, MSC sends the ALERTING message to the MS (MS translates it into ring back tone). This message is a DTAP message. If no answer is received from the called party and the calling party does not terminate the connection, the network will terminate the call or perform no answer call transfer after a while.

If the called party picks up the phone, MSC receives an ANSWER message. The link between the calling party and the called party is connected. MSC sends a CONNECT message in the CC protocol to the MS. After receiving this message, the MS sends a CONNECT ACKNOWLEDGE message in the CC protocol to the system. The system starts charging after receiving this message. If the called end is data device, it enters CONNECT status directly after receiving the SETUP indication. The call connection procedure is over and the two parties start the conversation or data transmission service.

1.13.4 Call Release

If the calling party hangs up first, the MS sends disconnect message to MSC through FACCH. After receiving this message, the MSC sends release message to inform the called party to terminate the communication. The end-to-end connection is over. But the call is not complete, because certain tasks such as sending charge indication are performed. When the connection to the MS is no longer necessary, the system sends a RELEASE message to the MS and starts T308. After receiving this message, the MS sends a RELEASE COMPLETE message to the system and the call is over. The MS stops the T308 after receiving the RELEASE COMPLETE message. Similarly, if the called party hangs up first, it sends a RELEASE message to the calling party. The MSC sends the calling party a DISCONNECT message after receiving the RELEASE message. If the call is terminated in an abnormal way, this message further indicates the cause for that.

When the MSC receives the RELEASE COMPLETE message from the MS, it sends a CLEAR COMMAND message to BSC to release all the signaling links. This message contains the cause for the call clearance, such as handover complete or location updating complete. The call connection release is over. If the abnormal release occurs because of radio link failure or device failure, the BSC sends a CLEAR REQUEST message to the MSC.

After receiving the CLEAR REQUEST message, BSC sends a CHANNEL RELEASE message to the MS and starts T3109 to show that all the lower layer links are released. Meanwhile, it requires the MS to enter the idle mode. When the MS receives the CHANNEL RELEASE message, it removes the uplink signaling link (to stop sending the measurement report of uplink channel associated signaling on SACCH). The MS sends DISC message to BTS and starts T3110. After receiving this message, The BTS sends UA to MS and the RELEASE INDICATION to the BSC. When the T3110 times out or the MS receives the UA frame, it enters the idle mode.

In order to ensure the timely removal of the uplink and downlink, when the BSC sends the CHANNEL RELEASE message to the MS for the uplink removal, it also sends a deactivate SACCH (SACCH) to the BTS requiring for the release of the downlink signaling (to stop the signaling connection between the two parties). After receiving this message, the BTS stops the transmission of the downlink SACCH frame and sends the deactivate SACCH acknowledgement to the MSC.

After receiving the RELEASE INDICATION message, BSC resets the T3109 and starts the T3111, and sends RF CHANNLE RELEASE to the BTS (the T3111 is reset at the same time), requiring for the release of TCH resources. When the BSC receives the RF CHANNLE RELEASE acknowledgement message from the BTS, it sends a CLEAR COMPLETE message to the MSC, indicating that the radio link clearance is over and the channel is available for reallocation.

After receiving the CLEAR COMPLETE message, the MSC releases the SCCP connection by sending RLSD and receiving RLC. The whole MS originating call flow is over.

1.13.5 Exceptional Situations

I. No Establish Indication Message Is Received After Channel Activation

The main causes are:

The MS may send many channel requests even if the BSS works well, which activates many signaling channels. But the MS only occupies one of them. Other channels are released by the BSC after the T3101 times out as they cannot receive the establish indication from the MS. If the Tx_interger is proper, the cause for this problem is that the uplink reception is normal but the downlink signal cannot be received by the MS. Under such circumstances, the received level and the received quality of uplink

and downlink should be checked. If the MS is not far away from the BTS but the received level and the received quality are bad, check the antenna feeder and the TRX in BTS.

Improper configuration of Tx-integer in BSC

The Tx-integer affects the interval of channel request re-sending. Improper Tx-integer only leads to the activation of many channels by BSS, but no call will be affected.

II. BSC Sending Immediate Assignment Reject

If the BSC sends immediate assignment reject to the MS after receiving the channel required message, the usual causes are:

No proper signaling channel is available for the MS because of all channels are busy or the channels are blocked.

BTS sends channel activation negative acknowledge after receiving the channel activation message.

If the BTS sends lots of channel activation negative acknowledge messages to the BSC, it is usually because the transmission at Abis interface is not stable, which leads to the inconsistent channel status of the BSC and BTS, or because errors occur in certain board of BTS.

III. MSC Sending Disconnect Message Instead of Assignment Request to Terminate the Call

In the call connection process, the immediate assignment is followed by the assignment procedure. But due to certain reasons, the MSC sends a disconnect message instead of the assignment request message to the MS and then terminates the call. Under such circumstances, many complaint phones from users cannot get through. Check the following:

The A interface circuit of MSC

The data consistencies of the A interface between the MSC and BSC, especially the circuit pool data.

IV. Assignment Failure

After receiving the assignment request, the BSC sends assignment failure message instead of assignment complete. The usual causes are:

No proper voice channel is available for the MS.

BSC has no proper voice channel for the MS because all the voice channels are busy or the channels are blocked.

The cause value carried by the assignment failure message is no radio resource.

The MS voice channel access fails.

Under this condition, the assignment failure is reported from the MS.

Due to the special features of the radio transmission, this kind of assignment failure occurs most frequently and is unsolvable. If the occurrence rate is too high, check the antenna feeder, the BTS board, and the parameters related to channel access in BSC data configuration.

The A interface circuit of BSC fails, for example, the CIC in the assignment request is not available. The hardware of BSC fails.

The cause value in the assignment failure message sent by BSC is equipment failure.

The transmission at A interface fails.

V. Directed Retry

After receiving the assignment request message from the MSC, if no TCH is available and the BSC allows directed retry, the BSC implements the handover with the cause value of directed retry to change the service cell of the MS.

VI. Exceptional Procedure Due to Call Drop

Call drop may occur any time during the call flow, which affects the following procedures. For example, the call drop occurs when the BSC receives the assignment request message from the MSC. The assignment procedure may be not complete (the channel may be just assigned and no assignment command message is sent). Under this condition, BSC may send clear request message instead of assignment complete message or assignment failure message to the MSC.

VII. Exceptional Procedure Due to Hangup

Hang up of the calling party or the called party may occur any time during the call flow, which affects the following procedures. For example, the hangup occurs when the BSC receives the assignment request from the MSC. Under this condition, the call flow may be terminated before the BSC sends assignment complete or assignment failure to the MSC. This assignment procedure neither succeeds (BSC sends assignment complete) nor fails (BSC sends assignment failure).

VIII. Exceptional procedure because MSC sends clear command

After the A interface connect is established, MSC may send clear command or disconnect message to the BSC during the call flow, which affects the following procedures. For example, the hang up occurs when the BSC receives the assignment request from the MSC. Under this condition, the call flow may be terminated before the BSC sends assignment complete or assignment failure to the MSC. This assignment procedure neither succeeds (BSC sends assignment complete) nor fails (BSC sends assignment failure)

If it happens many times, analysis the following two factors:

The cause value carried in the clear command

The cause value is usually the call control if the call is terminated in a normal way. Otherwise, the cause value may be protocol error, equipment failure, or others.

The interval between the clear command or disconnect message and the last message

The interval between the clear command or disconnect message and the last message indicates whether the exceptional procedure is triggered by timeout.

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