четверг, 1 октября 2009 г.

5.4 Traffic Statistics Index Analysis

At the network optimization stage, the traffic statistics indexes are the basis for network performance optimization. For network optimization, the KPIs, such as congestion rate, call drop rate, and handover success rate, are in common use. These indexes are the external representation of network quality. The radio coverage quality, channel capacity, and cell parameters are the internal factor to affect the network quality. The traffic statistics analysis aims to look into these internal factors through external factors. Since the mobile network is a complex system, you should consider related DT information, signaling messages, and alarm information for the overall analysis.

5.4.1 General Analysis Method

Traffic statistics analysis is performed from BSC overall performance to cell performance, from primary indexes to secondary indexes.

First you should have a rough understanding of the network performance through BSC performance analysis. Here the indexes such as THC traffic intensity, TCH call drop rate, TCH congestion rate, and inter-cell handover success rate should be considered. Attention that in addition to check the percentages of the indexes, you should also check the absolute numbers of the indexes, because the percentages may sometimes hide some cell problems.

After having understood the indexes about the overall network performance, you should analyze the indexes for each cell if finding abnormal indexes. First you should judge if the abnormal index is a common phenomenon or it is really an abnormal one. If it is a common phenomenon, you should begin the analysis from the perspective of coverage, capacity, frequency planning, and cell parameters. If it is really an abnormal case, you should register the corresponding traffic sub-items and analyze them in detail. In addition, you should also make an overall judgment through collecting the information about alarm, engineers' operation, and other external causes. If the traffic statistics analysis cannot contribute a correct judgment, you should employ DT equipment and signaling analyzer for help.

5.4.2 High Call Drop Rate Analysis

If the uplink and downlink quality deteriorates to a level that cannot hold normal conversation, the conversation will be disconnected. This is defined as call drop. Since the user mobility and radio propagation is uncertain, call drop always exists in a mobile network. However, optimization measures can be adopted to reduce the call drop rate.

When the call drop rate of the BSC overall performance is found abnormal, you can check TCH performance to judge whether the call drop is just a common phenomenon or it is an individual phenomenon. After that, you can judge whether the high call drop rate occurs in several cells or in all the BTSs. If the call drop is a common phenomenon, you should make an overall check towards the coverage planning, cell parameter planning, and frequency planning to analyze whether the link budget meet the requirements, whether the configuration of the path failure counter is rational, and whether the network interference is too great. In addition, you should also check the BSC hardware, and then perform drive test to check the network coverage.

If it the abnormality is caused by the severe call drop in individual cells, you should confirm whether it is equipment failure that caused the call drop. Generally, alarm messages are always come together with equipment failure, so you can take equipment failure as a reference.

After the equipment failure is excluded, you can analyze the call drop rate from the perspective of interference, coverage, and handover.

1) Interference is divided into uplink interference and downlink interference. You can analyze the uplink interference according to the number of interference bands into which the idle TCHs drop. It is normal that the idle TCHs drop into interference band 1 and interference band 2. For the network with aggressive frequency reuse, it is acceptable that the idle TCHs drop into interference band 3. Here the frequency hopping, PBGT handover and coverage control must be considered. If the idle TCHs drop into interference band 4 or above, you should carefully check the interference. Generally, the interference within the network increases with the traffic volume. The increase of the Rxqual class can be seen through the Rxqual measurement task and Rxlev measurement task. The poor handover ratio can be seen arising through inter-cell handover performance measurement. In addition, the handover re-establishment failures will result in more handover failures.

2) If the coverage is inadequate or it is unbalance on the uplink and downlink, the call drop will also be resulted. You can judge if the Rxlev is adequate through the

mean Rxlev of the power control measurement task and the power class. If the Rxlev is still low when the transmitter power reaches the maximum, there are areas with poor coverage. Meanwhile, you can take the mean Rxqual and Rxlev during call drop as a reference. The distribution of TA (timing advance) values can help you estimate the radius of subscriber distribution. Through checking the received channel strength of the neighbor cells, you can analyze the cell coverage. Generally, drive test is needed for a detailed analysis.

If the uplink coverage and downlink coverage are unbalance, RF component failure or cable connection problem will occur. The path unbalance can be seen from the path balance measurement task, power measurement task, and call drop measurement task. At this time, the alarm information and user complaint also deserve your attention.

3) Handover failure will prevent the MS from moving to the best cell. In this case, call drop may be resulted. In addition, cross-cell handover and target cell congestion may cause call drop. To solve this problem, you can add neighbor cell relationship and balance the traffic within the cells.

The high SDCCH call drop rate analysis is similar to high TCH call drop rate analysis. Acting as the point-to-point signaling channel, the SDCCH is more sensitive to the interference than TCH. In this case, the common method to reduce the call drop rate is to adjust the access threshold and reduce interference.

5.4.3 High TCH Congestion Rate Analysis

This section discusses TCH congestion, including the congestion caused by TCH seizure all busy and the congestion caused by TCH seizure failure.

When the congestion rate of the BSC overall performance is found abnormal, you can find out the cells with high congestion rate through checking the TCH performance statistics. In this case, you can discover the problems through analyzing each functional sub-item of the TCH performance statistics of this cell. In addition, you should check whether there is transmission problem, clock problem, or hardware problem through considering the alarm information.

It is a must to analyze the load according to the TCH traffic intensity and the configured TCH capacity.

1) Check if the THC congestion rate is caused by TCH seizure all busy through analyzing the TCH performance measurement of the cell. If the congestion is caused by heavy traffic, you should predict the real traffic of the cell and check if other cells can share the traffic. If it is beyond the optimization capability to enable other cells to share the traffic, you should consider expanding the capacity of the network. The adjustment measures for traffic balance may not be consistent with the principle of minimum radio path loss, so they are applied to emergent causes only. In most cases, you can balance the traffic through adjusting coverage scope, adjusting access threshold, adjusting CRO and handover threshold, or enabling load handover. If the congestion is not caused by TCH seizure all busy, go on with the check.
2) Check if the TRXs of the congestion cell work normally. The damage or performance decline of the uplink channels may prevent the MS from accessing other cells. In this case, many cells will be seized, which will cause congestion. The incoming cell handover performance measurement will show that many handovers towards this cell are failures. In this case, you should query the statue of each TRX within each cell through querying the Rxlev performance measurement task or Rxqual performance measurement task. In addition, you should find out which TRX is related to the abnormality through querying the uplink and downlink measurement reports of the same TRX.
3) Check if the congestion rate is related to interference, namely, check if any abnormality is present from the interference band 1 to interference band 5 in the traffic statistics. If the interference is present in a cell, the call drop rate of the cell will be high, and the SDCCH congestion rate will increase accordingly. Moreover, the RACH in the random access performance measurement may be congested, and the immediate assignment success rate will decrease.
4) Under some conditions, the congestion of some cells is a result of large coverage. In this case, you should analyze the relationship between TA value and Rxlev through querying the power control mean level, the mean level during call drop, and TA. In addition, you should also use drive test to define the coverage area of the cell. Through querying the TCH availability of the neighbor cell, you can confirm if the congestion is caused by neighbor cell failures. Through querying path balance performance measurement, you can judge if the reason for the TCH seizure failure is that the downlink power is greater than the uplink power.
5) Frequent handovers can also cause TCH congestion. Through querying the ratio of the handovers to the call seizure successes, you can check if the ratio is rational. Through querying the incoming and outgoing ratio, you can check if the congestion is caused by irrational handover.

5.4.4 High SDCCH Congestion Rate Analysis

The SDCCH congestion rate is mainly caused by heavy traffic. First you should define if the congestion is a common phenomenon or if it is just an individual phenomenon. If it is a common phenomenon, you should analyze if the location update timer is irrationally set, and then calculate the SDCCH capacity to see if it meets system requirement. If it is just an individual phenomenon, you should analyze it from the perspective of equipment, location area, and interference.

1) From the perspective of equipment, you should first check the TRX sound ratio in the BSC overall performance measurement and the SDCCH availability in the SDCCH performance measurement, and then check the TCH activation NACK/TIMEOUT in the

TCH performance measurement. After that, you can define if the congestion is caused by board problem.

2) Check the messages for SDCCH bearer location update. Irrational location area planning will cause frequent location update, which will result in SDCCH congestion. You are required to analyze of the edge of the location is set at the areas with a great number of subscribers by checking the location area planning and actual drive test. In addition, you are also required to check if the location update messages accounts a too larger percentage of the SDCCH seizure requests at the edge. The method is to query the ratio of the successful SDCCH seizures (location update) to the total SDCCH seizure successes in the SDCCH performance measurement.

3) Interference also causes SDCCH congestion. Especially for the networks in which the distance between BTSs is small and the BCCH frequency is aggressive, the system may receive more interference random access signals. The network will allocate a SDCCH for each random access, which causes SDCCH congestion. In this case, the immediate assignment success rate will decrease, the paging success rate will decrease, and the RACH in the random access performance measurement may be overloaded.

5.4.5 Low Handover Success Rate Analysis

The analysis for handover success rate is quite complicated, because it involves capacity, coverage, clock, signaling, equipment, and even MS.

1) If the handover success rate of all cells is low, you should check the problem from the perspective of handover parameters, A-interface circuit, and BSC clock.

2) Filter the cells with poor handover. If a network is run by the equipments of different carriers, you should check if it interoperability problem by comparing the inter-BSC handover success rata with the intra-BSC handover success rate in the handover performance measurement. Generally, the inter-BSC handover success rate is a little lower than the intra-BSC handover success rate. In addition, you need to monitor the signaling messages and data configuration between BSCs and analyze the radio link budget and clock of each carrier.

3) Check if any problem is present at the Um interface through comparing the handover success rate and radio handover success rate. The radio handover success rate is equal to or greater than the handover success rate. If the handover success rate is far smaller than the radio handover success rate, you should analyze the ground link and capacity. If the difference between the radio handover success rate and the handover success rate, you need to consider the interference.

4) Analyze if it is incoming handover failure or it is outgoing handover failure through querying the incoming cell handover success rate and outgoing handover success rate in the handover performance measurement. After that, analyze the outgoing cell handover performance measurement and incoming cell handover performance measurement of the problem cell so as to find out the incoming handover failure cells from the outgoing cell performance measurement. Confirm if the poor handover is caused by target cell congestion through analyzing the "incoming cell handover failures", "TCH traffic intensity", and "TCH congestion rate (all busy)" of all the incoming handover failure cells.

5) Check if any equipment fails through querying the TRX sound ratio, TCH availability, and TCH activation NACK/TIMEOUT of the target cell. Analyze if the TRX performance decreases through querying the Rxlev performance measurement of the target cell.

6) Check if any ground link equipment fails through querying the A-interface failures and the ground link breaks during TCH seizure.

When the microwave is used for the transmission or during inter-BSC handover, the clock deviation is another cause for poor handover. And this can be proved by the intra-BSC handover failures. For the cells where the clock synchronization is unavailable, the BSIC cannot be decoded, so the handover can never occur. In this case, you need to check if the clock is normal and analyze the call drop rate.

If these two causes are excluded, you need to make adjustment from the perspective of coverage and interference.

To reduce call drop rate and enhance handover success rate, you can leave a margin for the Rxlev and Rxqual during handover. If the Rxlev of a cell is lower than -90dBm during handover, you should check the mean Rxlev and TA value of TCH call drop in the call drop performance measurement and analyze drive test to see if the coverage distance of the cell is too long and if the signal is not strong enough.

For the networks in which better cell algorithms are enabled, you should check the "attempted handovers (better cell)". It is better that the percentage it accounts 60% of the handover causes.

The interference will also affect the handover success rate. When the interference is present, the voice quality will decrease and the call drop rate will increase.

Handover problems are rather complicated. To solve the problems arising in actual work, you are supposed to integrate the methods introduce above, the signaling analyzer, equipment condition, and drive test into consideration.

Автор: ourdot на 1:34

Подпись комментария: Выбрать профиль...

Отправить комментарий Просмотр

Следующее Главная страница Предыдущее

Подписаться на: Комментарии к сообщению (Atom)