

Processing Mobile Switch Data Using Visual Basic Application

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Abstract

GSM (Global System for Mobile communication) is a digital mobile telephone system that is widely used. Communication plays a major role in today's world and to support it QoS (quality of service) has to be given maximum priority.

Today, QoS is regarded as the crucial element of strategic competitiveness and the hallmark of commercial success in mobile business.

In this paper VBA programming language is used to develop a program that produce useful information to be used for assessing QoS for mobile companies by analyzing MSCs (Mobile Switching Center) data activities on daily basis. The data taken is real data, for Iraqna Company for mobile (2004-2008).

Keywords : GSM, QoS, MSC, GPRS, BSC, GOS, VBA, OMC, BTS, Erlang

الخلاصة

ان GSM (النظام العالمي لاتصالات الموبايل) هو النظام الرقمي لتلفون الموبايل الواسع الانتشار. ان الاتصالات تلعب دور مهم في عالمنا اليوم ولغرض الارتقاء بها فانه الاولويه القصوى يجب ان تعطى لجوده الاداء. تعتبر اليوم جوده الاداء العنصر المهم في المنافسه الاستراتيجيه والعلامه البارزه في النجاح التجارى في وظائف الموبايل. في هذا البحث استخدمت لغه البرمجه VBA لتطوير برنامج والذي ينتج معلومات مفيده لاستخدامها في تقييم جوده الاداء لشركات الموبايل بواسطه تحليل بيانات انشطه MSC (مركز بداله الموبايل) على اساس يومى. البيانات المستخدمه بيانات حقيقيه لشركة عراقنا للموبايل للفترة (2004- 2008).

1- Introduction

GSM (Global System for Mobile Communications) is a trademark owned by the GSM Association, it is a cellular network, standard set developed by the ETSI (European Telecommunications Standards Institute) to describe technologies for second generation (or "2G") digital cellular networks, developed as a replacement for first generation analog cellular networks, the GSM standard originally described a digital, circuit switched network optimized for full duplex voice telephony. The standard was expanded over time to include first circuit switched data transport, then packet data transport via GPRS (General Packet Radio Service). Packet data transmission speeds were later increased via EDGE (Enhanced Data rates for GSM Evolution). The GSM standard is succeeded by the third generation (or "3G") UMTS standard developed by the 3GPP. GSM networks will evolve further as they begin to incorporate fourth generation (or "4G") LTE Advanced standards.

Mobile services based on GSM technology were first launched in Finland in 1991 [1].

The GSM Association estimates that technologies defined in the GSM standard serve 80% of the world's population [2]. Communication plays a major role in today's world and to support it QoS has to be given maximum priority [3].

To enable experts to assess QoS a powerful programming tool need to be used to analyze the data coming from the MSC (Mobile Switching Center) which controls the whole network including the BSCs connected to it. To achieve this task the programming language Visual Basic for Applications (VBA) is used.

2- Quality of Service

To realize the importance of QoS initially we have to ask, why do we need QoS ?. Imagine a situation where you are hardly able to hear what your friend is talking over the phone or the phone gets cut when you are talking something important. These things are highly undesirable and you do not want to get low quality service for paying high monthly bills.

Quality of Service (QoS) has been defined as the collective effect of service performance which determines the degree of satisfaction of a user of the service [4].

QoS are mechanisms for controlling the performance, reliability and usability of a telecommunications service. Mobile cellular service providers may offer mobile QoS to customers. QoS mechanisms are always provided for circuits switched services (circuit switched is a telecommunications technology by which two network nodes establish a dedicated communications channel (circuit) before the nodes may communicate) [5].

2.1- Factors affecting QoS

Many factors affect the quality of service of a mobile network. It is correct to look at QoS mainly from the customer's point of view, that is, QoS as judged by the user. There are standard metrics of QoS to the user that can be measured to rate the QoS. These metrics are: **coverage**, **accessibility** (includes GOS(Grade of service)), and **audio quality**. In **coverage** the strength of the signal is measured using test equipment and this can be used to estimate the size of the cell. **Accessibility** is about determining the ability of the network to handle successful calls from mobile-to-fixed networks and from mobile-to-mobile networks. The **audio quality** considers monitoring a successful call for a period of time for the clarity of the communication channel. All these indicators are used by the telecommunications industry to rate the quality of service of a network. The QoS in industry is also measured from the perspective of an expert (e.g. teletraffic engineer). This involves assessing the network to see if it delivers the quality that the network planner has been required to target. Certain tools and methods (protocol analyzers, drive tests and Operation and Maintenance measurements), are used for this QoS measurement:

- Protocol analyzers are connected to BTSs (Base Station Controller), BSCs (Base Station Controller) and MSCs (Mobile Switching Center) for a period of time to check for problems in the cellular network. When a problem is discovered the staff can record it and it can be analyzed.
- Drive tests allow the mobile network to be tested through the use of a team of people who take the role of users and take the QoS measures discussed above to rate the QoS of the network. This test does not apply to the entire network, so it is always a statistical sample.
- In the Operation and Maintenance Centre (OMCs), counters are used in the system for various events which provide the network operator with information on the state and quality of the network.
- Finally, customer complaints are a vital source of feedback on the QoS, and must not be ignored [5].

2.2- Cellular GOS

A crucial part of QoS in mobile communications is GOS (grade of service). In general, GOS is measured by looking at traffic carried, traffic offered and calculating the traffic blocked and lost. The proportion of lost calls is the measure of GOS. For cellular circuit groups an acceptable GOS is 0.02. This means that two users of the circuit group out of a hundred will encounter a call refusal during the busy hour (busy hour is when the traffic intensity is the greatest) at the end of the planning period. The grade of service standard is thus the acceptable level of traffic that the network can lose. GOS is calculated from the Erlang-B formula (the probability of call loss on a group of circuits), as a function of the number of channels required for the offered traffic intensity [5].

3- VBA is a useful tool

Visual Basic for Applications (VBA) is an implementation of Microsoft's event-driven programming (flow of program is determined by event, e.g. mouse click) language Visual Basic 6 and its associated integrated development environment (IDE), which are built into most Microsoft Office applications. VBA enables developers to build user defined functions, automate processes and access Win32 and other low-level functionality through DLLs (Dynamic-link library). As its name suggests, VBA is closely related to Visual Basic and uses the Visual Basic Runtime, but can normally only run code within a host application rather than as a standalone application. It can, however, be used to control one application from another using OLE (Object Linking and Embedding) Automation. Microsoft allows embedding and linking to documents and other objects. For example, it is used automatically to create a Word report from Excel data [6].

VBA, which has been available since Excel 5.0 and is a subset of Visual Basic, is a full featured, structured programming language and thus far more powerful. Indeed, because VBA allows the programmer to program and thus control Excel's rich collection of drawing and chart objects, it might be considered more potent than VB itself.

Using VBA in conjunction with the Excel spreadsheet, we have the convenience of a spreadsheet for neatly-formatted input/output. Meanwhile well-structured, readable, line-oriented code can be used for the more complicated calculations [7].

Using VBA enable us to process the data of OMC counters and presented them in excel sheet ready for QoS team to compare it with the relevant KPIs (key performance indicator) to benchmark mobile networks in terms of QoS, this would enable mobile network operators to enriches their knowledge of their strengths and weaknesses to provide the basis for identifying options to maximize revenue and business potential [4].

4- Design of the program

The program consist of 4 subprogram, each one response to one of the button command in sheet START in the excel work book. Two of them handle one way circuits (one direction traffic) and the other two handle two way circuits (two direction traffic). Flowcharts are attached at the end of this paper.

Two way circuits information differ from one way circuit as the traffic comes and goes through these circuits because these acts as GATES and have many tasks such as: delivering calls to subscribers , connecting outgoing calls to other mobile subscribers, and some other tasks [8].

Traffic is measured by Erlang (Erlang is a dimensionless unit that is used in telephony as a statistical measure of offered load or carried load on service-providing elements such as telephone circuits or telephone switching equipment) [9].

Each subprogram consists of two arrays, the first one contains the circuits in concern and the second contains the information related to these circuits, except the subprogram of the third button which contains three arrays, the third array merely for the BSCs.

As mentioned earlier , in the OMC , counters are used in the system for various events , we call this data observation , this observation is submitted by the SSP(Service Switching Point) , this data is extracted on daily basis on a text file each observation has a record format and many classes, this text file is imported to the excel sheet1, then the data is directed into columns according to our need. The data is forced into the cells, so the cells will act as string functions chopping the information to match the programmer needs.

5- Results

The observation data listed in sheet1 consists of several classes, class F is the one we are concern with. Class F contains all the information of the circuits group, MSCs, BSCs etc, as all the events being occurred over air interface are triggering different counters in these circuits group.

Pressing ONE WAY CIRCUIT will list all the BSCs with their information at the busy hour in sheet 2. These informations are:

FO: traffic passed through circuit.

FE: calls completed.

FS: circuits in use (if FS less than FQ this indicate some circuits are not working and need investigation).

FP: calls attempted. `

FR: calls rejected.

FQ: circuits equipped.

The last column is the Used Capacity, and this is calculated by dividing Total Traffic by the FS, when this value reaches 75% or 80% this indicates that these circuits need expansion (Figure 1).

The name of these BSCs are (TBG30,TBG32,...etc) refers to the BSCs in different areas, for example TRMD1,2,3 BSCs in Ramady city, to ensure mobile call coverage in that city.

Similarly TWO WAY CIRCUIT will list all the two way circuits with their information at the busy hour in sheet 3 . These informations are:

FOA: traffic arriving.

FOD: traffic departed.

FS1: circuits in use.

FEA: completed calls arriving.

FED: completed calls departed.

FQ1: circuits equipped.

FPA: attempted calls arrived.

FPD: attempted calls departed.

FRA: rejected calls arrived.

FRD: rejected calls departed.

PRS1: premium rate service.

Because there are arriving and departed traffic in two way circuits, the total traffic is the sum of FOA and FOD, and the result will be divided by FS1 to get the used capacity for each circuit.

The name of two way circuits is either refers to its location, as TNDW1 for Dawodi area in Baghdad or to what it represents like MLINK which refers to the international Gateway, and this handle the traffic between our network and networks in other countries. For KORK1, its traffic represents the traffic between our network and the local KORK network.

The unique aspect of the telecommunications industry to which we refer is the fact that a telecommunications company gets its revenue from a network that is expected to operate 24 hours a day, and generally does so automatically. This is particularly true for telecommunications service providers because their business depends on their networks being operational 24 hours a day, 7 days a week, independent of any external occurrences. Their customers have very little patience with network downtime, particularly if the competition is still operational [10]. So it is necessary to list the information for 24 hour to report any malfunction to fix it as soon as possible.

LISTING ONE WAY CIRCUIT button lists in sheet 4 one way circuits information during the past 24 hour (Figure 2) and at the same time it lists in sheet6, the busy hour of each BSC with their traffic carried during the last 24 hours, also it gives the maximum traffic which is the max value after summing the traffic of all the BSCs and we call this the Busy Hour of the Day (Figure3), and gives also the tentative calls.

LISTING TWO WAY CIRCUIT button lists in sheet5 two way circuits information during the past 24 hour.

Since this is a real data you may have noticed that some of the BSCs and other circuits without traffic (e.g. TBKR1: BSC for Kurkok, RTB16: BSC for Rutba, TSLU1: BSC for Suliamania) and this is because they have been established without being launched at that time or there is some problem with them and this need to be fixed.

Some circuits have zero traffic in some hours, this indicates that there is a problem in these hours and need some investigations.

Further work

The next step in our further work will focus on using the results obtained in this paper to produce advanced QoS report by comparing KPI (Expectation) versus the actual network KPI's (Perception) which have been achieved by mobile network operators. One definition of 'Quality' can be formulated as:

$$\text{Quality} = \text{Perceptions} - \text{Expectations}$$

A recommended set of Grade of Service values for circuit-switched mobile services should be indicated in advanced and standers should be set. The target for this KPI Indicator should be highlighted and met.

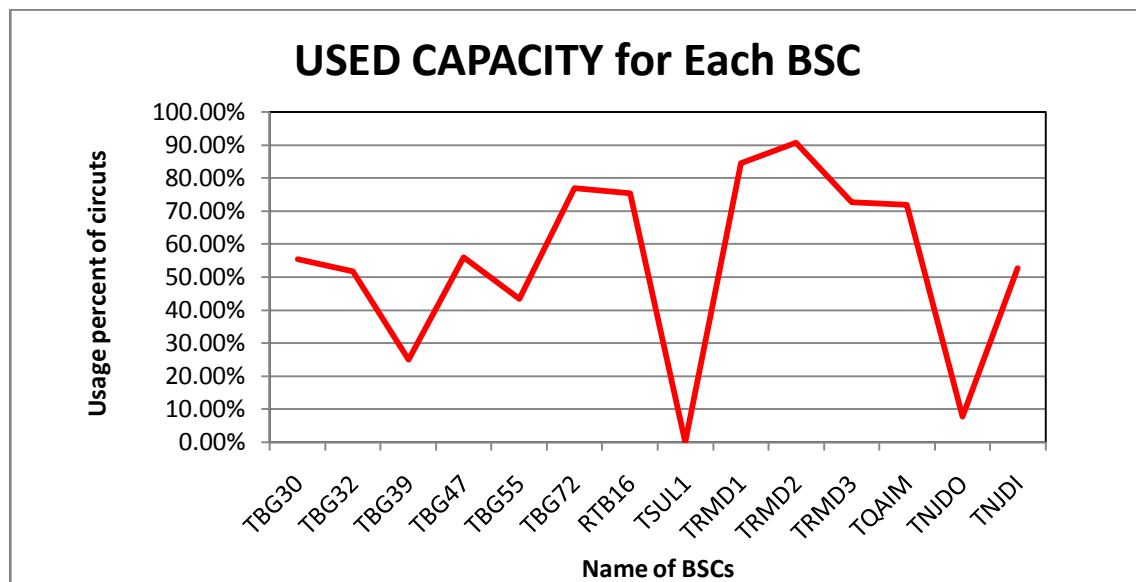


Fig. 1 used capacity for each BSC during a single day, most Mobile companies set a threshold of 80% at which the BSC capacity should be expanded by adding more circuits.

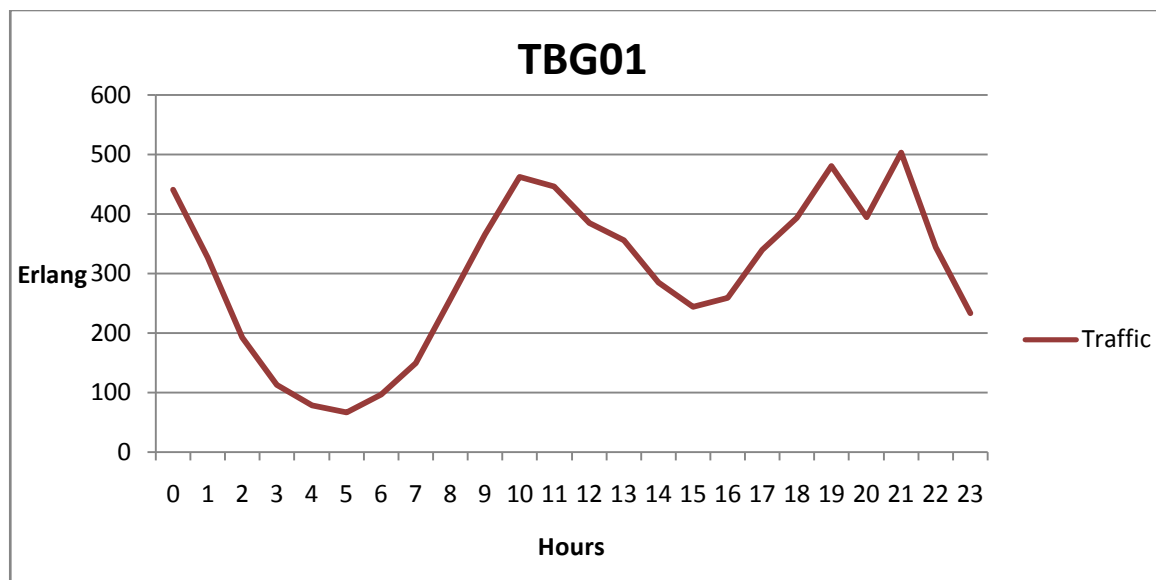


Fig. 2 BSC traffic during 24 hours , the curve shows the behavior of the people connected to this BSC

in using mobile services, the busy hour is at 21 in the evening.

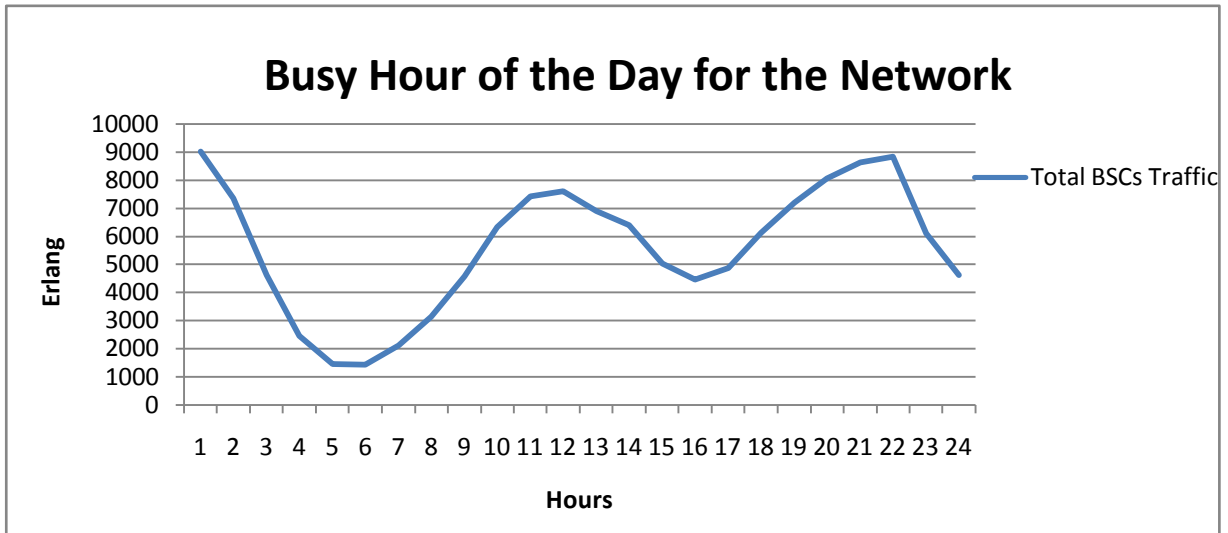


Fig. 3 The busy hour of the day for all the BSCs is at midnight which may differ from the busy hour for each BSC individually.

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