Effects of various Discount Packages on Performance of GSM Mobile Operators in Pakistan

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Mobile communication has been one of the fastest growing technologies in Pakistan. It was expected that the implementation of the GSM will bring effective telecommunication services that will support good speech quality, roaming, reasonable call rates, and minimized crosstalk etc. Its deployment into the market was well embraced by people and found to be relatively more efficient. However, this efficiency is being hindered by some factors leading to the degradation in services offered by the operators. Mobile phone operators are on a spree for increasing the number of subscribers by launching lucrative discount tariff packages. In order to assess how well mobile operators are meeting quality objectives in their network, especially during the discount tariff packages, various parameters such as, performance of call establishment, call cutting / dropping during the conversation and SMS send / receipt rates are needed to be analysed for performance evaluation of quality of service of these operators. This paper evaluates the performance of various GSM operators in Pakistan during the offers of discount packages and examines the problems of performance degradation.

Field of Research: Performance of GSM Mobile Operators in Pakistan

1. Purpose and Scope of Work

The idea of this study is to meet the following objectives:

(a) To adopt a methodology to carry out performance analysis for various GSM Operators in Pakistan during discount tariff package timings.
(b) To find out the observations / limitations of mobile operators and to give a set of recommendations for improvement of performance of the GSM services of various operators during discount tariff package timings.

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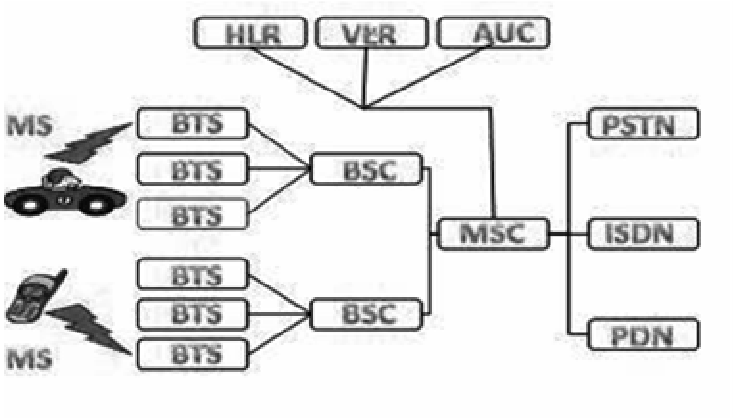
2. Introduction

2.1 GSM

In order to provide all of the services which are required,the customer finds the network behind the GSM quite difficult. Numbers of sections have been classified, as shown in Figure 1

Figure-1: Physical GSM Network Architecture



The section of a traditional cellular telephone network,Base Station Subsystem(BSS),holds the responsibility for handling traffic and signaling between a mobile phone and the Network Switching Subsystem (NSS) (Mikko Multanen, Kimmo Raivio and Pasi Lehtim¨aki, 2006). The allocation of radio channels to mobile phones, paging, quality management of transmission, reception over the air interface,transcoding of speech channels and many other tasks related to radio networks are carried out by the BSS. (Pasi Lehtim¨aki and Kimmo Raivio, 2005). The second major section of GSM network is the network and switching subsystem (NSS).It is sometimes called as the core network. It is part of the network which resembles to a fixed network. Many GSM services are produced by the combination of elements in the system such as voice calls and SMS.

2.2 GSM interfaces

2.2.1 Air interface or Um-interface

The interface between the MS (Mobile phone) and the BTS (Base Transceiver Station) is known as the Air Interface. It is required for supporting: -

(a) Universal use of any compatible mobile station in a GSM network
(b) A maximum spectral efficiency

2.2.2 Abis-interface

The interface between the BSC (Base Station Controller) and the BTS is called as the Abis-interface. Traffic and control channels are comprised by this interface. The Abis-interface implements following functions:-

(a) Voice-data traffic exchange
(b) Signaling exchange between the BSC and the BTS
(c) Transporting synchronization information from the BSC to the BTS

2.2.3 A-interface

The interface between the BSC and the MSC (Mobile switching center) for signaling exchange between the BSC and MSC is the A-interface.

2.3 GSM Services

It is needed that the provider has a detailed knowledge about the quality of the offered service (CCITT Recommendation E.723, 1992),in this way service could be better used.The network characteristics can be defined, measured and controlled to achieve a satisfactory level of service quality by the concept of network performance. (Kerstin B. Johnsson and Gustavo Nader, Radio Link, 2004).
The operators of mobile radio networks are daily being faced with new challenges by the continuing vastness and technical progress in the telecommunication.In order to gain the largest share of growing number of mobile users, who naturally requires a high quality of service (QoS),operators are competing had in this race.The important factors that are used to differentiate between service providers are the round the clock availability and complete coverage coupled with acceptable quality at appropriate terms. Operators are not simpurging to meet these needs; If the aim of customer satisfaction is not to be put at stack then user requirements must be fulfilled.User satisfaction determines the further growth. Along with the required provision of the capacity and coverage,special attention must be paid to the quality.

3. Service Performance

The degree of satisfaction of a user of the service is determined by the Collective effect of the service performance. (.K. Al-Begain, I. Awan and D.D. Kouvatsos, 2003). The necessary aspect of the global evaluation of a service is the view of the users of the service. It is the task of the Service Provider to combine different network performance parameters in order to fulfill the economic requirements of the Service Provider as well as the satisfaction of the Users (ITU-T Recommendation E.771, 1993).
Knowledge from the intensification of competition in mobile markets suggests that competition, or the threat of competition, can often leads to significant downward strain on prices. Mobile operators not only compete by tumbling the charges on existing packages, but also use a number of other forms of competition. For example, introduce new service packages with lower implied tariffs and/or more free minutes) in order to attract new customers. In order for network operators to assess how well their networks are meeting objectives, especially during the discount tariff package timings,

performance of call establishment, call cutting / dropping during the conversation, SMS send / receipt rates need to be verified for the degradation of quality service if any. According to Ministry of Information Technology Mobile Cellular Policy, Telecom Operators are bound to roll out at least 70% network coverage of Tehsil headquarters in four years with minimum of 10% Tehsils in all provinces of Pakistan.

4. Related Work

Fifth, QoS survey of mobile operators was conducted by Pakistan Telecom Authority (PTA) Zonal Offices located at Peshawar, Rawalpindi, Lahore, Karachi and Quetta from September 4, 2007 through November 16, 2007 using the recently procured state of the art monitoring equipment. The services of five GSM operators i.e. Ufone, Mobilink, Telenor, Warid, and CMPak were checked in selected major and small cities.The voice distortion, call hangings, call connection time, air interface blocking, call completion rate, call quality etc are still the same issues for customers faced in rural and urban areas,this has been conveyed by the survey conducted. But this work has not been done specifically for discount tariff package timings till date. The data reflected for Islamabad region in the PTA survey for year 2007 is shown in the table 1 below:-

a. Voice

S.No	Operator	Total Calls	Network Accessibility (%) TH= 99.5%	Service Accessibility (%) TH= 99.5%	Call Completion Ratio (%) TH=96%
1	Mobilink	119	100%	97.50%	99%
2	Ufone	208	100%	97.50%	**94.10%**
3	Telenor	202	99.60%	98.80%	97.30%
4	Warid	208	99.60%	99.20%	99.20%
5	CMPak	201	100%	96.30%	97.80%

b. SMS

S.No	Operator	Total Attempts	Service Accessibility (%) (TH $\geq$ 99%)	Access Delay (TH $\leq$ 2)
1	Mobilink	20	100.00%	**5.85**
2	Ufone	29	**93.10%**	**10.14**
3	Telenor	20	100.00%	**5.3**
4	Warid	20	**95.00%**	**4.75**
5	CMPak	20	**95.00%**	**5.9**

The data clearly mentions that as far as the voice are concern, all the mobile operators except Ufone were having excellent performance in terms of call completion ratio. However, as far as the SMS is concerned most of the operators were below the required level in terms of service accessibility as well as in access delay.

5. Various discount packages offered by the mobile operators

The various major discount packages offered by mobile operators are depicted in Table 2.

MOBILINK		**WARID**	
Details	**Rates**	**Details**	**Rates**
Jazz Ladies First Tariffs		**Crazy Hour**	
Calls to Any Mobilink number (11pm - 7am)	Rs. 5.00 / hour	As many calls any time, any day, to as many Warid numbers as you like	Rs.9.99 + tax per hour
Calls to Any Mobilink number (3pm-6pm)	Rs. 1.50 / min	Unlimited calls to all numbers (Warid to Warid) from 12am to 7am	Rs. 25 + tax daily.
Jazz Octane Tariffs		**60 Paisa Package**	
Late Night Option - All Mobilink numbers	Rs. 0.40 / 30 sec	9 a.m till 5 p.m in the evening	Rs.1.2 + tax per minute
Calls to Favorite Mobilink Numbers	Rs. 1.5 / 3 minute	5 p.m. till 9 a.m	Rs 1.5 + tax per minute

TELENOR		**UFONE**	
Details	**Rates**	**Details**	**Rates**
		Ghanta Package	
On all Telenor numbers from 10 am till 5 pm	only 20 paisa/30 second	Entire day from 9 am to 5 pm	5.99/hour
TalkShawk 30 Sec FnF time is from 6am to 6pm	for various packages	Late night calls discount Ufone to Ufone (Midnight to 7am everyday)	Rs. 2.5 per hour
ZONG		Weekend calls discount Ufone to Ufone (9AM to 5PM)	Rs. 4.99 per hour
Unlimited Free Numbers (Midnight to 7:00 am)	Free	24 Hours a day, 7 days a week	Daily Subscription Charge Rs. 29.99/-
Late Night Offer (Midnight to 7:00 am)	Rs. 3.99 per hour		
Happy Hour	Rs. 4.99 per hour		
Break Time Offer (Noon to 2:00 pm)	Rs. 3.99 per hour		
Break time offer Fridays Only(Noon to 4:00 pm)	Rs. 3.99 per hour		

6. Methodology

The research is qualitative and exploratory and different tools like interviews and questionnaires are used for data compilation and further analysis. The aim of conducting the empirical work of this research is to provide material for hypothesis to aid the identification and reasoning about the effects of various discount packages on performance of GSM mobile operators in Pakistan. The work was carried by using formal and informal interviews, in which open-ended questions were asked. The interviews were asked to identify the different service performance and a list as a questionnaire was designed depending on the individual's feedback. Qualitative analyses were done on the basis of the questionnaire. The research concluded by giving recommendations to overcome the degradation in service performance.

7. Data collection/Analysis

A Performance for finding the effects of various discount packages on performance of GSM mobile operators in Pakistan was designed and same was distributed among various groups of people.

8. Summary of the Results collected

Overall the questionnaires were submitted to a total of 1200 individuals from different cities of Pakistan i.e. Karachi, Lahore and Rawalpindi / Islamabad. Out of these, a total of 1024 individuals responded. The mobile service operator usage by the various people out of this sample space is as follows in table 3: -

Mobilink	238 individuals	23.00%
Ufone	224 individuals	21.87%
Telenor	189 individuals	18.45%
Zong	178 individuals	17.38%
Warid	195individuals	19.30%

Overall about (78) % people are not satisfied with the mobile operator's performance with the dominant reason of poor services especially during the discount tariff package timings. The discount tariff packages problems out of the sample space of respective mobile service are summarized below in table 4: -

S.No	Problems during discount tariff timings	Mobilink	Ufone	Telenor	Zong	Warid
1	Call Establishment	78.0%	75.8%	67.1%	57.3%	63.0%
2	Call cutting out	47.0%	57.1%	59.2%	53.3%	50.7%
3	SMS sending or receipt	80.6%	69.6%	83.0%	70.2%	75.8%

4	Noise/ distortion	69.7%	63.3%	72.0%	65.7%	58.5%

Moreover overall about 88% people are in favor of Discount tariff packages out of which 93% are those who do not want to compromise on Quality of service while having discount tariff package.

9. Theoretical Study to analyze the (QoS) problems.

9.1 Outgoing Call Technical completion (OC TCR) rate

When a mobile subscriber dials a number from his handset and the called party rings, the terminology is called Outgoing call and technically this process is called outgoing call technical completion (OC TCR). The high utilization of Trunk groups during the peak time causes the outgoing refused seizures which is the main cause for the degradation. OC TCR drops during peak hours because of high traffic and Trunk congestion problem (K. Al-Begain, I. Awan and D.D. Kouvatsos, 2003).

9.2 Incoming call Technical completion rate (IC TCR)

When a mobile subscriber receives a call on his handset and mobile rings, the terminology is called Incoming Call and technically this process is called incoming technical completion rate. The reason is of decrease in IC TCR during the busy hour due to high traffic and congestion in trunk circuit groups.

9.3 SMS

SMS is defined as Short message service. It is value added service which allows a mobile subscriber to exchange short alphanumeric messages. Concerning the SMS incoming completion rate, the failed transfers lead to multiple re-attempts from the SMSC (Short Message Service Center).

10. Research Analysis

The problems were analyzed both qualitatively and technically. Following are the analysis of the research carried out: -

In the aspect of Network Accessibility (call establishment), Mobilink is at 78% percent with highest problem in call establishment during discount tariff package timings. A close second with the overall average of 75.8% is Ufone. Telenor is at 67.1% while Warid and Zong were next with 63% and 57.3% respectively. For call cutting problem, this time it is Telenor leading with 59.2% call cutting observations while Ufone is on second position with 57.1% problems. Zong is on the third position with 53.3% while Warid and Mobilink last with 50.7% and 47% respectively.

After having the qualitative analysis of the call establishment problem as well as by considering it through technical aspects, OC TCR and IC TCR rate generally degrades because of the incomplete calls due to shortage of outgoing trunks and problems related to the circuit assignment.
The performance of SMS sending or receipt was also checked in addition to voice transmission. Telenor was having highest percentage i.e. 83% SMS sending or receipt problems, with Mobilink at second position with problem percentage of 80.6%. Warid, Zong and Ufone are all very close with 75.8%, 70.2% and 69.6%. SMS outgoing completion rate is less which could be from dialing incorrect number, lack of credit, call barred, SMS not accepted by SMS center, service not supported by subscribers etc.

The data also mentions that people are in favor of discount tariff packages but they do not want to compromise in any case on the Quality of Service as it is the most essential factor in establishing and developing the communication network.

11. Recommendations

As various trunk groups / circuits suffer from high utilization rate during peak hours, it is recommended to improve the circuit maintenance (out of service circuits must be made in service) and addition of circuits in the highly utilized Trunk groups. Radio resource planning and optimization is highly needed, especially for paging failures during Incoming call. Routing problems can also cause the degradation in both OC/IC call completion rate so it is recommended to check the routing database so as to overcome this problem.
For SMS failure problems, link between SMS and MSC should be properly checked to meet the requirement. Mobile operators must launch their own QoS and customer feedback surveys to get the exact voice of the customer regarding issues of network. Because within increase of customer base by offers, it is indeed the network infrastructure and quality that will force customers to remain loyal on the same prefix code.
Mobile operators also have to pay attention over issues like RF planning, Installation of cell sites and installations' outsourcing in the proposed areas and they must ensure the quality infrastructure is durable; vendors of outsourced installations should be audited to cater these problems instantly.
Further, it is recommended that the operator may be encouraged by the telecom regulatory authorities to offer the discount tariff packages to facilitate the customers but at the same time not to compromise the Quality of service as it is the most prime factor for the communication services.

12. Conclusions

This study contributes towards establishing a healthy competition among the mobile operators who continue to strive for development and improvement of their service in order to influence and attract new subscribers. It is quite clear that in order to bring in new technology and perk up the service with the aim of providing the best service at cheapest rates to the subscribers; PTA is carrying out its mandated mission.

The present results indicate that the performance of GSM networks for various operators during discount tariff package timings is still a far cry from the expectations of the consumers. From this study, we recommend that there is a need for system optimization in Radio Network side (UM Interface) and Circuit Side from MSC (A and Abis Interface) in order to improve the call setup success rate. Also a recommendation has been suggested for checking of link between SMSC and MSC in order to overcome the problems in SMS sending or receipt. Telecom operators must pay attention over issues like RF planning, Installation of cell sites and installations' outsourcing in the proposed areas and they must ensure that the infrastructure has quality and is durable. Moreover, vendors of outsourced installations should be audited to handle the problems instantly.

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