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Evolution of the Quality of Service (QOS) Parameters for the Short Message Service (SMS): Review Paper

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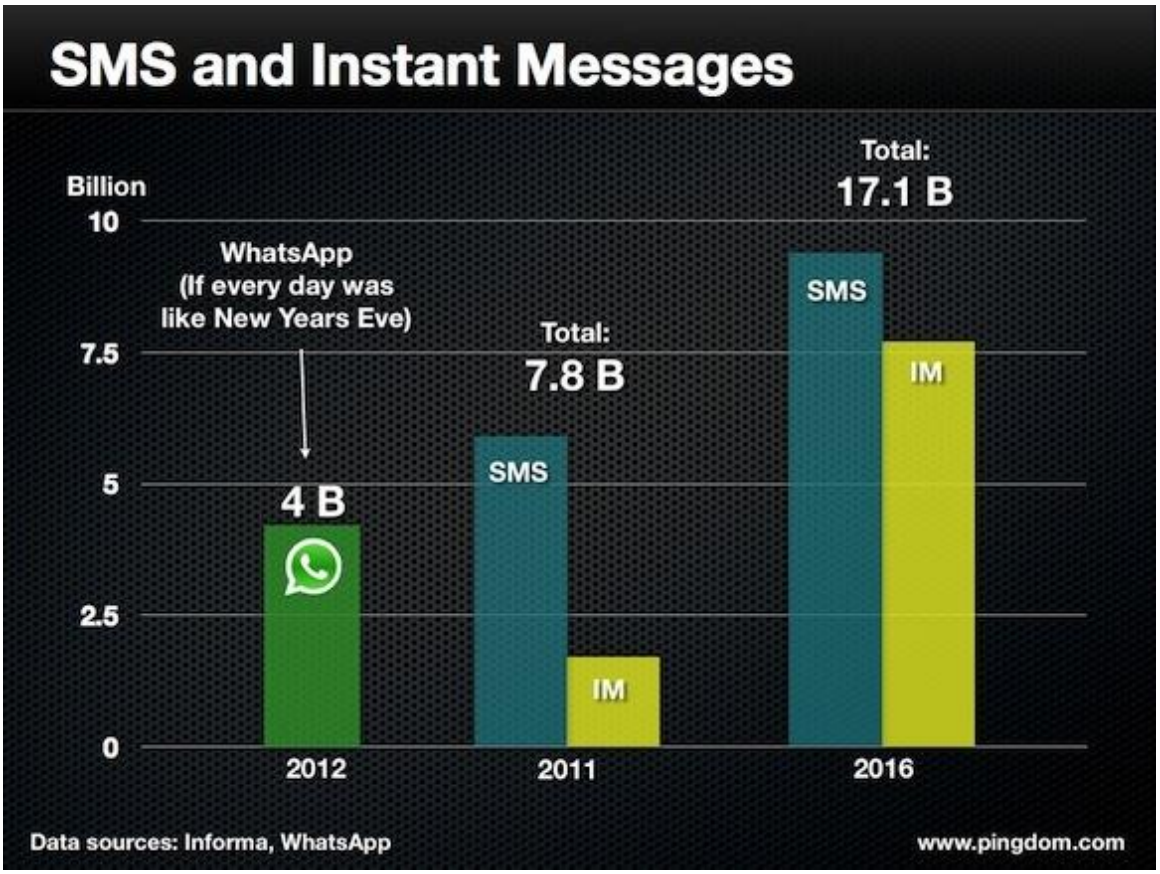
Abstract
The widespread usage of SMS services in cellular systems and increasing number of service providers necessitates concerning of SMS QoS in these systems. This paper proposed six groups of telecommunication QoS and SMS QoS studies, groups are classified according to the objective, the objective of each group is as followes :group AQoS definitions, parameters and parameters computations, group BTelecommunication QoS monitoring systems, group C Setting target values of telecommunication QoS parameters, group DNon-utilization QoS of ICT services, group EImproving SMS QoS and group FMeasurements of SMS QoS parameters**.** A number of SMS QoS studies conducted since 2003 and appeared in literature are fully assessed.

I. INTRODUCTION

The increasing penetration of mobile networks is due to its ability of offering services during subscribers roaming. Telecommunication QoS organizes the relationships between telecommunication companies, service providers, regulators and subscribers. It determines the quality limit of the provided services. ITU defined QoS as degree of user satisfaction[10] . Short Message Service (SMS) is the most popular service in mobile systems for:

- It is low feeservice .
- Every subscriber to a mobile network that supports SMS can be reached via SMS.
- There is an increasing number of SMS applications (value added SMS- based serviceor premium services). Fig(I-1) below illustrates that the global number of SMS in 2016 is expected to be 9 billion messages, till 2016 SMS penetration is superior over IMS [20].

There are many factors affecting SMS QoS:-
1\ High revenue is the main goal of service providers, so they conducting services like SMS with low cost and low quality.
2\ Subscribers have no ability to select the adequate service provider.
3\ System subscribers are not aware about their rights.
According to the factors mentioned above, it is the high time that governments take serious effort for monitoring service providers performance, publish reports explaining the results of monitoring and apply obligations against service provider which introduced performance less than the specified level.



Fig(I-1) :www.Pimgdom.com

Table (I-1) **below shows Nineteen studies in the area of telecommunication and SMS QoS are classified to six groups according to the most common features, which may be objectives or methodologies or other common features.**

Table(I-1)**: Telecommunication QoS for SMS Studies Classifications**

Group	Number of studies	Common features
GROUP A	4	Introduce QoS definitions, parameters and parameters computations.
GROUP B	3	Telecommunication QoS monitoring systems
GROUP C	2	Setting target values of telecommunication QoS parameters.
GROUP D	3	Non-utilization QoS of ICT services.
GROUP E	3	Improving SMS QoS.
GROUP F	4	Measurements of SMS QoS parameters.

II. ROUP A Telecommunication QoS definitions, parameters and parameters computations

The main issue of this category is the Telecommunication QoS definitions, parameters and parameters computations, which is composed of studies [1],[2],[3] and [4]. [1]Established a uniform approach toQoS across ITU-T and eliminate the confusion resulting from different frame work and inconsistent definitions, andDefined telecommunication QoS from four points of view:- 1\QoS offered by provider. 2\ Customer's QoSrequierments.3\QoS achieved by provider. 4\QoS perceived by customer.

In [2] QoS parameters are classified as follows :- 1\ sevice independent QoS parameters.
2\ Direct services QoS parameters. 3\ Store and Forword services QoS parameters.
Also [2] and [4] proposedQoS parameters model,[2] and [3] proposedfour SMS QoS parameters :- a\ SMS Service Non- Accessibility MO.b\ SMS Access Delay MO . c\SMS Completion Failure Ratio.d\SMS End-to-End Delivery Time, however for computing SMS successful attempts in [3] and [4], the equation does not consider the dropped notifications between receiver and SMS centre and between SMS centre and sender.

ETSI document is main reference of [3] and [4], [4] proposed six SMS QoS parameters:-

a\ Service Accessibility SMS MOb\ Service Accessibility SMS MT.c\ Access delay SMS MO.
d\ Access delay SMS MT.e\ End-to-End Delivery Time for SMS MO. f\ End-to-End Delivery Time for SMS MT.
In [4] all defined QoS parameters and their definitions are on field measurements, that indicates the measurements were made from customer point of view[Full end-end perspective] .

III. GROUP B Telecommunication QoS monitoring systems

[5] Proposed Global Roamer System which monitor and measure QoS during international Roaming,Comparisons QoS of SMS and basic call for international routes between Malysia and (USA, Pakistan and South Africa) is the main advantage of this study.The methodology of the Gloabal Roamer monitoting system based on test calls and test SMS messages.

Describing the implementation procedures for measuring the quality of SMS, voice and data roaming services end-to-end.is the main issue of study [6], itintroduced table of results of monitor and measurement of many services parameters by many monitoring systems(end-to-end active testing, SS7 monitoring and camel), the monitoring is done by Roaming HubbingProvider,HPMN and VPMN.The contribution of this study can be summarized as 1\providing QoS improvement by proper monitoring it.2\The document helps the user or SP or vendor to select the better method to measure specific parameter at specific condition .

Increasing QoS/QoE of IP-Based platforms to regionally agreed standard is the objective of study [7],it introduced measurement objectives and methodologies for performance and quality, including appropriate reference network model and proposed information about building blocks to form of QoS and their mechanisms. The study introduced common understanding about NP, QoS, QoE and SLA and their relationships.

IV. GROUP C Setting target values of telecommunication QoS parameters.

Studies [8] and [9] are in the area of setting target values of telecommunication QoS parameters.[8]focusing setting target values of parameters govern end user satisfaction, it identifiedeight distinct categories of Telecommunication QoS,the model of categories is based on end-to-end user perception.

The categories (performance targets) provide indications of the upper and lower boundaries for applications to be perceived as essentially acceptable to the user and determines whether a bearer channel qualified to carry agiven application's data.

Reference values of parameters relevant to time are specified for telephone, SMS, MMS and data services by study [9], which proposed classification of measurement environments.

V. GROUP D Non-utilization QoS of ICT services

Recommendation ITU-T E803 is the main reference of studies in this category.The area of Non-Utilization Telecommunications QoS is the main issue of [10],[11] and [12]. [10] only focusing non-utilization stage of telecommunication QoS and lists 88 parameters over the product life cycle of ICT service.The study provides :- 1\ Enable customers and users of ICT services to compare performance of service providers of ICT services. 2\ QoS performance on non-utilization stages can benefit customers, regulator, stakeholders and service providers to monitor performance levels for the benefit of the customer and ICT industry.

[11]proposes anew and updated trend for the contractual behaviour taking into consideration many factors, like customer legal level of contractual understanding, customer awareness level, safety considerations and governmental restrictions.Authors of[12]Customizing Non-Utilization Telecommunications QoS Parameters for Developing Countries Based on the ITU-T E.803 Recommendation.

VI. GROUP EThe improving of SMS QoS.

SMS QoS improvement is the contribution of all studies in this category. An efficient SMS transmission in cellular Network using Load Adaptive Multi Access with Collision Avoidance protocol (LAMA/CA) is the objective of study [13] in which Channel access probability depend on channel load (LAMA). Authors in [13] Introducing Backoff mechanism which prevents SMS messages from blocking the signal channel and sopreventing packet loss due to delay exceeding life time of the message, but channel utilization is limited due to the restricted transmission at the beginning of the time slot. Improvement of SMS QoS- based buffer optimization is the objective of [14] and [15],In study [14] the optimization is performed on line, as aresult, the approach can be used to continuously adjust the buffer size, butthe study derive sensitivityestimates which might not always deliveraccurate performance estimates for a "real" discrete-event system . The authors in [15] considering QoS requirements to the new and forword messages and design an optimal buffering scheme for SMS transfer in GPRS/UMTS Networks, however theyConsidering the system is homogeneous GPRS/UMTS SMS Networks.

VII. GROUP FMeasurements of SMS QoS parameters

Measurements of SMS QoS parameters is the target of studies [16],[17],[18] and [19].The study [16] is based on traces of SMS in real, operational cellular network that collected at SMS centre.The authors in [16] examined the three main factors that affects SMS Reliability, the first is flash-crowd event, the second is bulk message delivery and the third is the topological structure of the social network formed by the SMS users. Dynamic channel allocation, rate regulation mechanism and simulation preventing virus propagation are the suggested solutions for their effects respectivel. But the reported failure ratio is an underestimatingbecause study not considerd unsuccessful transmission attempts.

Authors in [17] proposed a Reconfigurable QoS Monitoring Framework for Professional Short Message Services in GSM Networks, the study contributes :- 1\Assessment and analysis of SMS QoS in the signaling domain, and proposing the appropriate parameters. 2\System framework for SMS QoS monitoring, alerting and reconfiguring an SMS centre3\.Improves SMS QoS level and reduces the efforts of SMS centre.4\Reduce packet loss due to inadequate received signal quality.butmodifications of many SMS parameters are must because they are unknown or can not be obtained at SMS centre. A quantitative Analysis of the quality of service of SMS in Philippines is proposed by authors of study [18],the study introduced 1\Considering the unsuccessfull sending attempts.
2\ completion rate given more weight by cubing it instead of squaring at previous equations.
3\The first measurements of SMSQoS provided by the three carriers in Philippines .
4\Comparison between the QoS of the three carriers in Philippine.

Evaluation Procedure for QoS of SMS. International SMSroute analysis is the main issues of thesis [19], in which the author introduced QoS evaluation for international SMS traffic according to correctness of the delivered messges.This thesis suggests a method of quality of service (QoS) assessmentfor international SMS service which combines two types of tests, end-to enddelay measurements and various verification tests.To become a worldwide premium service, service provider can sign contract with one or more SMS gateway provider instead of owining SMS centre, on the other hand Sending packet pairs in different rates can"t fully explain fluctuation of the network traffic flow.

Note:- [5] [19] evaluated SMS QoS during international roaming. [2][4] proposed models for QoS parameters. methodologies described in [16][17] applied on SMS center, both studies are based on messages in real world operational cellular networks.[13] [16] proposed different solutions for solving the blocking problem of the signal channel.

VIII. Conclusion

- In general and from the groups implemented it was found that most of SMS QoS studies are concerned the evaluation of QoS parameters.
- The area of messaging QoS research is now mature in multimedia applications but still there is need of improving and monitoring SMS QoS due to its widespread.
- Setting target values for SMS QoS parameters is necessary for improving and monitoring SMS QoS.

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