

## Survey based assessment of QoS deliverance from user's perspective towards MUET's Internet Service

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### ABSTRACT

Internet has become essential part of our daily lives and its usage with standard quality of experience (QoE) is highly demanding. To ensure this, network operators continuously monitor their systems performance from operator as well as user's perspective. However, user's QoE and their input is highly important to understand the strength and weakness of network operators. In this work, we aim to reduce/understand the gap between user's perspective of network performance versus the performance of network from operator's perspective. As a case study, MUET's Internet service has been taken into consideration to find the parameters that lead to high level of satisfaction from user's perspective.

**Keywords:** MUET, Intranet, Internet, user's Satisfaction

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### I. INTRODUCTION

The network operators are well aware of the parameters that impact performance of their network. To keep the quality of service (QoS) to a standard value and satisfy customer's demand requires some sort of deep insight. Several factor are involved such as reliability, up time and stable download and upload speed. In this competitive market, Internet Service Providers (ISPs) fight for market share and work their best to keep the customers to themselves via customer's satisfaction. However, rising trend in number of users and their variable demands makes it hard for ISPs to provide promised QoS to its users. To find the correlation between the user's feedback and uncompromising QoS parameter is very important. For this reason, a survey is designed with closed-ended questions. To analysis the survey, various statistical methods such as regression and correlation analysis were used. Moreover, to cope with the problem of adequacy of sample size, selection of samples, and reliability. Several tests such as Cronbach's alpha [1], [2], Kaiser-Meyer-Olkin (KMO) [3], and Bartlett's [4], [5] test was conducted.

The results suggest that the sample size is adequate and the designed questionnaire has internal consistency. Moreover, the results suggest that the students, staff and faculty members face issues related to Internet, while a few of respondents did not have access to the Internet. The statistics show that there is positive relationship between Internet speed and users satisfaction. The paper is organized as follows. Problem statement

and an overview of description about survey questionnaire are mentioned in Section III and IV. Section V discusses outcomes of survey based study using statistical analysis. Finally, conclusions are drawn.

### II. LITERATURE REVIEW

The use of technology and availability of e-resources has brought a great deal of improvement towards learning process. Recently, authors in [6] have done survey based study to find the factors to improve QoS from users perspective using QoS model in the domain of e-learning. Authors in [7], suggest that nowadays institutes require a reliable campus network connectivity. In [8], the authors conducted survey based analysis of their campus network and emphasized the need for good Internet service quality to enable users to use it for education. Another survey in [9], suggested improvement in management skills and awareness towards technical issues and learning education system over the years. The user's directly or in directly inter connect with Internet to see resources has enriched the teaching, learning, and research study environment [10]. Hence, it is important to ensure efficient use of existing network resources and guarantee high up-time as well as quality of experience (QoE).

W. linlin and Z. Rong [11] analyse and evaluate service quality factors based on customer experience. In [12], authors conducted a survey about Telecom services to identify the major impact of user's satisfaction. The work also emphasized that there is no any ma the magically

model which can perform real time measurement with respect to user's satisfaction towards QoS/QoE. It is necessary for any organization specially educational organization to contribute towards user's satisfaction surveys. To do so, survey is conducted to analyse the network behavior and to know the level of satisfaction of Internet user's. The survey is based upon the two leading component of user's satisfaction QoE and QoS as discussed by A.Kassler and S.Sargento [13]. It is important to manage the Internet traffic with proper measurement to know what is happening in network as well as to know about end user's activity [14]. Authors in [15] use a tool called DB Stream to analyse campus Internet traffic. Network data inspection and reliable network communication is the basic factor in the modern society. Hence, it is important to understand the factors that impact the QoS and QoE from user's perspective.

### III. Problem Statement

Rising trend in number users and devices to remain connected globally through Internet has challenged ISPs to maintain standards related to QoS. From operator's perspective, optimization of performance parameters is very important. However, it is important to know what parameters are important from user's perspective to ensure high level of satisfaction. Hence, it would be interesting to know what is the correlation between optimization of network parameters and user's satisfaction.

### IV. RESEARCH QUESTIONNAIRES

To understand user's behavior towards level of satisfaction and expectations of quality of experience, a closed ended questionnaire was designed and is as follows.

Q1 Do you a vail the Internet service at MUET?

- Yes
- No

Q2 Why do you not a vail the Internet service at MUET?

- Just not interested
- Don't have computer
- Don't have access
- Too difficult/frustrating

Q3 How often do you face difficulty in connecting to the Internet using wired network of MUET?

- Never
- Rarely
- Sometimes
- Frequently

- Constantly

Q4 How often do you face difficulty in connecting to the Internet using wireless network of MUET?

- Never
- Rarely
- Sometimes
- Frequently
- Constantly

Q5 How often do you face interruptions (disconnectivity or unresponsiveness) in Internet connection using wired network of MUET?

- Never
- Rarely
- Sometimes
- Frequently
- Constantly

Q6 How often do you face interruptions (disconnectivity unresponsiveness) in Internet connection using wireless network of MUET?

- Never
- Rarely
- Sometimes
- Frequently
- Constantly

Q7 Please rate the level of satisfaction towards the quality of Internet service experience (line speed, browsing experience etc.) using wired network of MUET?

- Never
- Rarely
- Sometimes
- Frequently
- Constantly

Q8 Please rate the level of satisfaction towards the quality of Internet service experience (line speed, browsing experience etc.) using wireless network of MUET?

- Never
- Rarely
- Sometimes
- Frequently
- Constantly

Q9 What is your required Internet speed/band width to achieve your satisfaction level? Assuming you are getting reliable and stable data rate?

- 2Mbps
- 4Mbps
- >4Mbps

Q10 Is the current setup of using VPN/Mikrotik to connect to the Internet bothering you in anyway?

- Not at all
- Minimal
- Sometimes
- Mostly
- Completely

The questionnaire uses ordinal Likert-type scale [16], and the collected data was from population approximately N = 594 users that had variation in age, gender, and education as shown in Table I. The data was collected during the period of May to August, 2018 in printed form that respondents filled.

TABLE 1  
 Distribution of Age, Gender and Education

Category		Frequency	Percentage
Gender	Male	542	91.2%
	Female	52	8.8%
Age	20-25	550	92.6%
	26-35	28	4.7%
	31-35	13	2.2%
	Above>36	3	0.5%
Qualification	Graduate	516	86.9%
	Postgraduate	64	10.8%
	Ph.D.	14	2.4%

## V. RESULTS AND DISCUSSION

To ensure consistency and measure the scale of reliability, Cronbach’s alpha test resulted with a value of 0.72, which is greater than standard threshold value of 0.7. This tells that the questionnaire has internal consistency and can be used for analysis. However, higher value of alpha ( $\alpha$ ) does not necessarily represent higher degree of internal consistency as its value depends upon number of items (N), average inter-item covariance ( $c^-$ ), and average variance ( $v^-$ ) as seen by equation (1)

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N - 1) \cdot \bar{c}} \quad (1)$$

For this reason, we ensure the adequacy of sample size via Kaiser-Meyer-Olkin (KMO). The KMO test resulted with the value of 0.79, which is greater than standard threshold of 0.7, suggesting the data is adequate for factor analysis. Bartlett’s test for sphericity resulted with the significance value of 0.000, which is less than the standard threshold value of 0.05, indicating that the correlation matrix is different from identity matrix.

Hence, the results are significant. Table II shows the results of KMO and Bartlett’s test.

TABLE II  
 Kaiser-Meyer-Olkin (KMO) and Bartlett’s Test

Kaiser-Mayer-Olkin Measure of Sampling Adequacy	Bartlett’s Test of Sphericity		
	Approx-chi-square	Degree of freedom (df)	Significance level (Sig.)
0.796	3388.683	91	0.000

The interesting question to answer for instance would be to know if males and females answer differently. Mann-Whitney [17] test was conducted to answer this, and the corresponding 2-sides p-value for each is shown in Table III. The results suggest that the males and females have similar answering tendency as p-value is greater than 0.05. Moreover, it would also be interesting to know if the level of education has an impact on the answers to the questionnaire. To answer this, Kruskal-Wallis [18] test gave us p-value shown in Table IV, suggesting no evidence of impact of education on answers to questionnaire.

## VI. DESCRIPTIVE ANALYSIS

The results of response to the questionnaire (Q1) are shown in Fig. 1 suggesting that the majority of the users avail the Internet services. However, to understand the reason behind not using Internet services, a branched question is asked and the statistics collect in questionnaire (Q2) are shown in Fig 2. The results suggest that the majority of the users don’t have computer to avail Internet services of MUET. Among the respondents were staff members who do not have dedicated computer to operate or little to no interest to avail Internet services at MUET. To understand the ease of Internet connectivity at MUET, the survey results shown in Fig. 3 and Fig 4 suggest that Internet connectivity via wireless network tends.

TABLE III

MANN-WHITNEY TEST

RQ	Gender	N	Mean Rank	Exact Sig.( 2-tailed)
Q1	Male	542	296.41	0.249
	Female	52	308.85	
Q2	Male	542	295.96	0.039
	Female	52	313.57	
Q3	Male	542	299.99	0.242
	Female	52	271.57	
Q4	Male	542	297.53	0.989
	Female	52	297.20	
Q5	Male	542	294.19	0.117
	Female	5	331.99	
Q6	Male	542	296.10	0.497
	Female	52	312.12	
Q7	Male	542	294.88	0.216
	Female	52	324.78	
Q8	Male	542	297.68	0.933
	Female	52	295.63	
Q9	Male	542	299.73	0.256
	Female	52	274.27	
Q10	Male	542	297.11	0.851
	Female	52	301.57	

to have higher tendency towards connectivity issues. Probable reasons could be variation in signal strength and coverage issues. The survey questionnaire (Q5 and Q6) suggest that users feel wired connection is more reliable and face lesser unresponsiveness on wired network as compared to wireless network as shown in Fig. 5 and 6. The statistics shown in Fig. 7 and Fig. 8 suggest that majority of the users don't feel satisfied with quality of Internet experience. The ratio of worst case experience is greater in users that use wireless network. However, users prefer using wireless network due its ease of mobility in campus area. Moreover, the statistics shown in Fig. 9 suggest that the users are not satisfied with current network bandwidth, while some users inadequately demand at least 2 Mbps to fulfil their needs. Nevertheless, most of users are not happy with network speed and demand more bandwidth and less delays. The statistics in Fig. 10 suggest that the respondents are not happy with ease of internet connectivity setup. Moreover, the users showed concerns that the user authentication based mechanism to access internet is not smooth. The statistics shown in this paper

TABLE IV

KRUSKAL-WALLIS TEST

RQ	Education	N	Mean Rank	Asymptotic Sig.
Q1	Graduate	516	296.94	0.453
	Postgraduate	64	302.56	
	Ph.D	14	286.00	
Q2	Graduate	516	296.50	0.241
	Postgraduate	64	308.28	
	Ph.D	14	285.00	
Q3	Graduate	516	297.01	0.795
	Postgraduate	64	306.50	
	Ph.D	14	274.39	
Q4	Graduate	516	297.13	0.811
	Postgraduate	64	305.30	
	Ph.D	14	275.46	
Q5	Graduate	516	297.64	0.998
	Postgraduate	64	396.85	
	Ph.D	14	295.25	
Q6	Graduate	516	297.90	0.960
	Postgraduate	64	292.91	
	Ph.D	14	303.79	
Q7	Graduate	516	296.33	0.548
	Postgraduate	64	314.85	
	Ph.D	14	264.82	
Q8	Graduate	516	293.79	0.302
	Postgraduate	64	316.19	
	Ph.D	14	348.93	
Q9	Graduate	516	302.00	0.158
	Postgraduate	64	262.85	
	Ph.D	14	289.25	
Q10	Graduate	516	299.61	0.535
	Postgraduate	64	276.88	
	Ph.D	14	313.93	

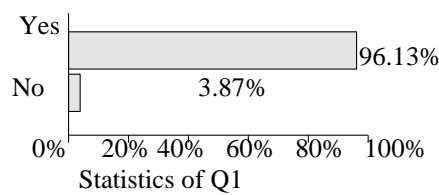
Sheds the light on the aspects of satisfaction that acts as a fundamental influence. The survey results and analysis let us know the satisfaction level of users towards Internet service at MUET. Moreover, the work has been useful in knowing the demand and critical factors / parameters that keep high importance.

**VII. CONCLUSION**

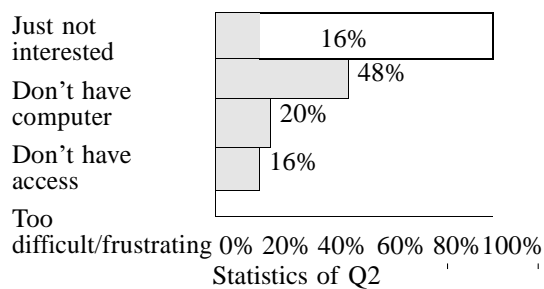
In our work, we have designed the survey with closed ended questions. These questions are later tested to ensure for its reliability and internal consistency through standard methodology. The collected data is then analyzed to ensure proper sample size and selection of samples. Finally, the statistics are analyzed and the results suggest that the users, specifically students prefer ease of

mobility while using Internet. However, research scholars and faculty members prefer reliable and smooth internet speed. User based authentication method to access internet services at MUET via VPN method has shown to be an inconvenience to majority. It is inferred from research study that user's satisfaction towards internet services at MUET is low and the feedback through this survey can be utilized to optimize the network performance.

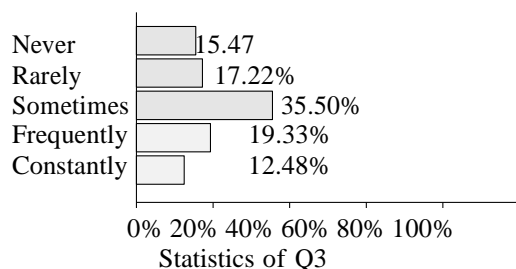
In future, we plan to compare the results of survey at other universities and find the correlation between the parameters.



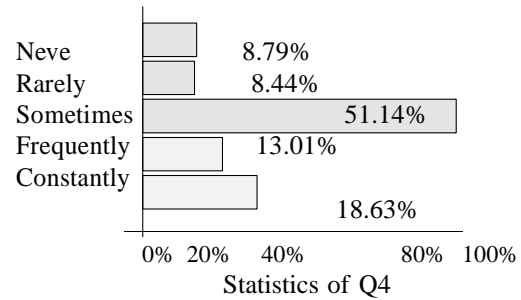
**Fig. 1.** Percentage of users availing Internet services



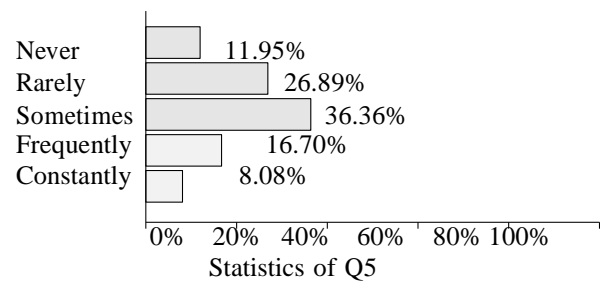
**Fig. 2.** Percentage of users not availing Internet services



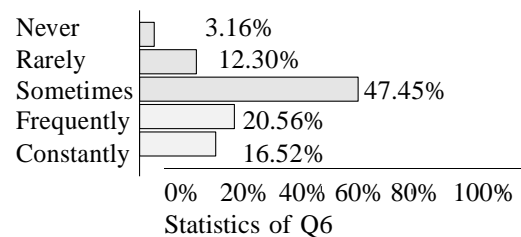
**Fig. 3.** Percentage of users facing difficulty towards Internet connectivity (wired)



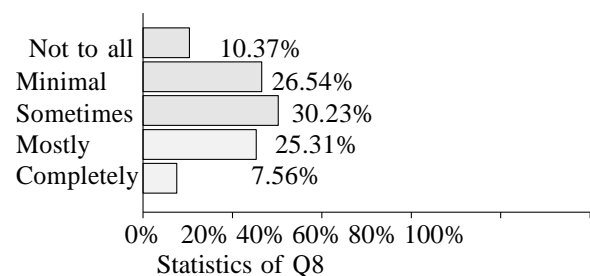
**Fig. 4.** Percentage of users facing difficulty towards Internet connectivity (wireless)



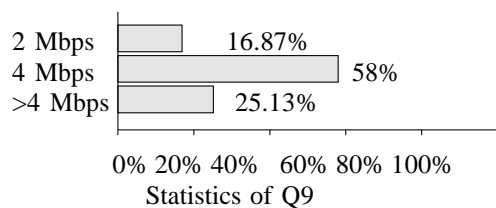
**Fig. 5.** Percentage of users facing unresponsive-ness while using Internet (wired)



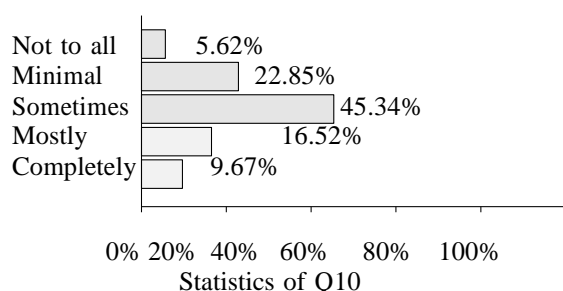
**Fig. 6.** Percentage of users facing unresponsiveness while using Internet (wireless)



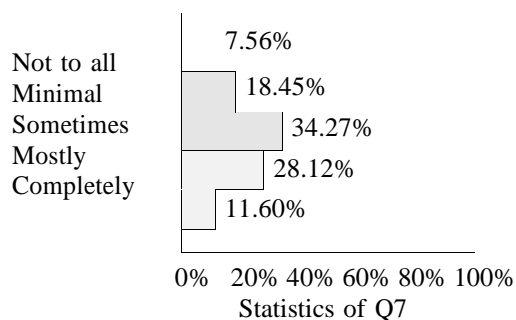
**Fig. 8.** Percentage of service experience (line speed, browsing experience etc.) using Internet (wireless)



**Fig. 9.** Percentage of demand for speed/bandwidth to get reliable and stable data rate



**Fig.10.** Percentage the user's satisfaction towards Internet connectivity setup/method.



**Fig. 7.** Percentage of service experience (line speed, browsing experience etc.) using Internet (wired)

### REFERENCE

- [1]. Lee J. Cronbach. Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3):297–334, Sep 1951.
- [2]. Mohsen Tavakol and Reg Dennick. Making sense of cronbach's alpha. *International Journal of Medical Education*, 2:53–55, 2011.
- [3]. Barbara A. Cerny and Henry F. Kaiser. A study of a measure of sampling adequacy for factor-analytic correlation matrices. *Multivariate Behavioral Research*, 12(1):43–47, 1977. PMID: 26804143.
- [4]. M. S. Bartlett. Tests of significance in factor analysis. *British Journal of Statistical Psychology*, 3(2):77–85, June 1950.
- [5]. George Waddell Snedecor and William Gemmell Cochran. *Statistical Methods*. Iowa State University Press, 8th edition, 1989.
- [6]. J. Upadhyaya and N. J. Ahuja. Quality of service in cloud computing in higher education: A critical survey and innovative model. In *International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC)*, pages 137–140, Feb 2017.
- [7]. Gary S Lynch. *Single point of failure: The 10 essential laws of supply chain risk management*. John Wiley and Sons, 2009.
- [8]. Oyeronke O. Ogunlade, Esther Joshua, and Amos A Ogunlade. Assessment of internet service quality and customers' satisfaction in university of ilorin, ilorin, nigeria. *Journal of Education and Practice*, 4(20):81–87, 2013.
- [9]. M. Roknuzzaman. A survey of internet access in a large public university in bangladesh. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 2(3):86–105, 2006.
- [10]. Kian-Sam Hong, Abang Ahmad Ridzuan, and Ming-Koon Kuek. Students' attitudes toward the use of the internet for learning: A study at a university in malaysia. *International Forum of Educational Technology and Society*, 6(2):45–49, 2003.
- [11]. W. Linlin, Z. Rong, L. Zheng, and S. Guang. The exploration of evaluation method of telecommunication service quality based on customer experience in transition period. In *2007 International Conference on Service Systems and Service Management*, pages 1–5, June 2007.
- [12]. N. Khan, M. U. Akram, A. Shah, and S. A. Khan. Important attributes of customer satisfaction in telecom industry: A survey based study. In *2017 4th IEEE International Conference on Engineering Technologies and Applied Sciences (ICETAS)*, pages 1–7, Nov 2017.
- [13]. A. B. Reis, J. Chakareski, A. Kassler, and S. Sargento. Quality of experience optimized scheduling in multi-service wireless mesh networks. In *2010 IEEE International Conference on Image Processing*, pages 3233–3236, Sept 2010.
- [14]. A. Callado, C. Kamienski, G. Szabo, B. P. Gero, J. Kelner, S. Fernandes, and D. Sadok. A survey on internet traffic identification. *IEEE Communications Surveys Tutorials*, 11(3):37–52, march 2009.
- [15]. Arian Bar, Pedro Casas, Lukasz Golab, and Alessandro Finamore. network traffic monitoring. In *2014 International Wireless Communications and Mobile Computing Conference (IWCMC)*, pages 611–616, Aug 2014.
- [16]. Patrick E. McKnight and Julius Najab. Mann-Whitney U Test, pages 1–1. American Cancer Society, 2010.
- [17]. William H. Kruskal. A nonparametric test for the several sample problem. *Ann. Math. Statist.*, 23(4):525–540, 12 1952.
- [18]. William H. Kruskal. A nonparametric test for the several sample problem. *Ann. Math. Statist.*, 23(4):525–540, 12 1952.

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