Universal Journal of Communications and Network 2(4): 63-69, 2014 http://www.hrpub.org
DOI: 10.13189/ujcn.2014.020401

The Impact of Critical IPTV Factors on Customer Satisfaction

Abdul Nasir*, Shahzada Alamgir Khan

Institute of Communication Technologies, NWFP University of Engineering Technology, Pakistan
*Corresponding Author: nachakzai@hotmail.com

Abstract The aim of this paper is to find out and check critical factors, which have a great impact over IPTV Customer Satisfaction. The research studied factors like Quality of Services, Channel Zapping Time and Repairing Packet Loss in network for Customer Satisfaction. The research is based upon primary data, which was collected through a questionnaire from the respondents of IPTV customers. The correlation analysis was applied to get the research results. The correlation showed positive significant relationship among all the variables. This research will help the telecommunication managers and engineers to reengineer and design their IPTV services strategies, which is helpful to maximize IPTV Customer Satisfaction.

Keywords Quality of Service, Channel Zapping Time, Repairing Packet loss, IPTV Customer Satisfaction

1. Introduction

The basic theme of this research is to get the customer satisfaction by improving quality of services by giving interactive extraordinary features. Basic aim is to reduce channel zapping time which is the main factor of dissatisfaction of current IPTV customers. Need is to concentrate on packet losses and adopt different type of successful techniques and methods of repairing packet loss. Which might beneficial to reduce flickering on live IPTV streaming in network. Given mention problems observed during IPTV services. Which are the focus areas of this study.

a) Currently IPTV services consume large bandwidth and having limited features.
b) Most complicated structure and QoS is not up to the mark. Interactive features like HD channels, friend call, online gaming, online marketing need to be implemented.
c) Channel Zapping time is high .
d) Packet Jitter (Delay) exists in the current IPTV Platforms.
e) IPTV VoD services consume large number of unicast traffic, which may cause congestion problem.

This research has aim that how Customer will kept satisfied from IPTV service. The following are the main objectives of the study.

1. To find out the impact of QoS on customer satisfaction
2. To find out the influence of Zapping time over customer satisfaction
3. To know the effect of Repairing Packet Loss over customer satisfaction
4. To proposed model for increase customer satisfaction from IPTV service.

2. Literature Review

2.1. Internet Protocol Television

Deployment of Internet Protocol based Television (IPTV) over various broadband access networks has largely been made possible by the increased availability of bandwidth on new kinds of access networks alongside improved media coding algorithms. The rising number of deployments and potential clients has motivated operators/solution providers to optimize network architecture used in delivery, mechanism for control, and end-user devices, in addition to enabling easy usage of enhanced services.

In general, IPTV systems have undergone evolution with respect to digital broadcast by using IP in highly advanced user-centric as well as service-oriented interactive platforms. [1] describes an IPTV system as a compendium of modern technologies in ICT brought together to deliver a wealth of services and top quality multimedia content over IP. IPTV systems offer sophisticated, customized, as well as personalized services, with interactivity presumed to be the major variation from traditional media. The services are accessible and controllable using various devices extending from traditional TV remote controllers to the advanced mobile devices such as smart- phones, and tablets [2].Most, if not all the current IMS-based IPTV solutions limit

personalization to context-knowledgeable personalization via recommendation.

2.2. Quality of Services

IPTV is representative of a set of multimedia services transported over IP networks and managed in order to guarantee quality of service, security, interactivity as well as reliability. IPTV has emerged as a strong competitor against conventional television providers in nations where the technology embraced. This has enabled it to offer typical Live TV services alongside a set of supplementary services including video on demand (VoD) private virtual recording PVR personal video recording as well as interactivity services, which are credited with improvement of TV experiences [3]. Today, there are various Telco providers which have implemented IPTV services over their existing networks, conventionally, IPv4-based networks.

Quality of services in IPTV platform is referred to control the Jitter loss , Flickering , and give interactive IPTV features like On screen Gaming , Online Marketing ,Online chatting on TV screen , HD channels , Android features , TVOD (Transactional video on demand) , OTT .

By giving such features, we can be able to satisfy our IPTV customers more successfully .Second way out is to remove congestion from network. So that IPTV services run smoothly .Main aim is to avoid and manage congestion in network. And it can be only done by some of resource reservation techniques, which can be more help full in maintaining quality of services.

By taking more understanding from [4] about quality services and quality of experience, at the time of provisioning IPTV equipment everything should be taking in mind that what kind of services and features has been taken from vendor side. Make sure that given IPTV features are more users friendly to operate. Running the equipments by operator technical operational staff would have better impact on quality of services control mechanism. Concerning more about IPTV quality of services with respect to customer satisfaction by using certain protocols, which help to control quality of services with its experience discussed in [5] .Now having resource reservation techniques and protocols in system like CAC (connection acceptance control), RSVP (Resource reservation protocols), IntServ (Integrated services) ,DiffServ (Differentiated services) in platform will provide better help managing and controlling quality of services. All such protocols, services, and features provided by different telecom sectors for their smooth services and customer satisfaction [6].

Further more user friendly EPG and attractive features like PVR (personal video recording) & t-Learning and communication (distance learning channels) has been more beneficial for customer satisfaction discussed in [7] & [8].

Now in IMS based IPTV technology features like On-screen Messaging / chatting , On screen live streaming websites (You-tube, vimeo & daily motion), onscreen gaming , Online marketing screen (Mozek) discussed by [9] are also way out to best quality of services. Mention are the features by which IPTV customer will impressed and fully satisfy by its uniqueness. All such features are work on IMS SIP (session Initiation protocol) and RTSP Real Time Streaming Protocol.

For the termination and modification of different sessions in IMS based IPTV we take help from SIP approaches which I think more beneficial among others. Same approach has been suggested by [10] & [11] .By the help of these protocols, it gives hybrid approach to IPTV platform. So till now IMS based IPTV is best ever solution approach provide to IPTV services providers. Adopting these approaches operator may face some integration issues during IMS based IPTV commissioning .So certain measure will better before commission techniques like these.

In context of IPTV systems, IMS are representative of multimedia service platform architecture. The multimedia IPTV services such as broadcast services and content on demand that platform offers are regulated and managed using the IMS core sub-system. Additionally, service discovery as well as delivery concepts are not dependent on the underlying IP transport networks. Further, IMS core implements IMS functionalities standard including user registration, subscription as well as management [12]. Other functionalities include session management, routing, interaction with NGN services, interaction, and QoS control. The extra functional element extends IMS core without paying attention to special needs to alter IMS core functionality /interfaces. In general, combining multiple ICT technologies within IPTV systems requires a complex convergence of networks. Telecommunications evolution alongside ETSI/TISPAN offers Next Generation Network (NGN) architecture to facilitate integration of communication as well as interactive IPTV services into a unified system. IP Multimedia Subsystem (IMS) is a recognized standard for development of IPTV platforms. It is responsible to performance of tasks related to virtualization, inter-operability, subscription, billing, roaming as well as security, among others [13]. As a result, IPTV system deployment over IMS architecture is a compelling option to proprietary commercial implementation. Additionally, IMS architecture permits implement implementation of services, which have a capability to improve IPTV experience.

2.3. Channel Zapping Time

In IPTV platform channel zapping time is the total time frame between changing channels. Which is main issue in existing platform when it take more than three seconds from changing one channel to another channel. Need is to reduce this time to certain level that cannot felt by customer and which is basic aim to discussed further in this study.

In modern IPTV platform zapping time become very important entity because customer become upset when it take much time. Best ever effort during below mention review that actually how can we able to reduce channel zapping time in existing IPTV platform .For which we can

find certain technique and algorithms for studying this issue for the purpose of customer satisfaction.

IPTV operators should focused on decreasing zapping time between channels is the basic factor for IPTV customer satisfaction. It is also the main thing to improve quality of services and quality of experience.

Somehow improving Channel Zapping time need is to enable prejoin on access devices for decreasing time delay between channels change but it is not a permanent solution .We have to be focused on IPTV compression techniques and algorithms like (MPEG-2)(MPEG-4 H.264/AVC).

The feasible mechanisms seem like Microsoft ICC (Instant Channel Change) which somehow reduces the delay between channel change process[14]. Smith and D.E focused on mechanism that accelerates channel change.

Recent demand in this regards is to display some commercial advertisement between that three seconds of time during channel change. But positive approach is to reduce zapping time. Some studies have deep research on channel change frames, which take almost not more than 200ms of time [15]. It seems high then others but need more efficient techniques and algorithms in this regards.

For better understanding of impact of algorithms regarding zapping time reduction is well define in [14] work .

Certain techniques have been discussed now a day for improvement of customer satisfaction and even find intelligent methods for reduction zapping time.

It is clear that zapping time is the main source of improving customer satisfaction. Communication of access devices with STB needs more concentration regarding IGMP protocol and prejoin enabling. Because it plays a vital role in running IPTV services and channels change time. Best study has been made by [17]. Further more studies have been made on channel zapping time controlled on a specific standards and principals [18].

Normally 3 second of zapping time observed in running IPTV platforms but some studies focused on decreasing by 2 second of zapping time between channels and some is working 1 second, best solution is represented by [19].

In further reviews it found that some of bodies are working on MOS (Mean Opinion Score) [20]. By different type of testing and suggested models they want to reduce the channel zapping time. By MOS the author suggested the time that out of 3 second it should be 0.43 second. All though it is incomplete studies and have some blank spots having some more modification which have to be further more polished but it is better step toward decreasing zapping time.

In reviewing channel-zapping time decreasing, we have strong point toward improving quality of services for customer satisfaction.

2.4. Repairing Packet Loss

In common man's language, packet loss can be interpreted as loss of information between source and destination.

Packet loss in a network normally happens when the transmission path has congestion and excessive traffic is thus dropped. This may due to outage of some intermediate transmission links or some node failure. Or it may be due to some unexpected burst of excessive traffic than normal routine.

Certain techniques can be used for tackling this kind of situation. The most important is to use the Class of Services (CoS) on network devices, which is normally known as Quality of Service (QoS). This technique is used to mark and thus priorities the traffic on the basis of their nature. Traffic prone to delay and unable to recover itself is marked with high priority. Examples are voice, live video streaming. Other types of traffic e.g, http, ftp etc are TCP based and are able to recover using mechanism of retransmissions and are therefore marked with normal/low priority.

Packet loss also effect IPTV multicast stream. In that case customer observes jitter / flickering on his screen which is not good for customer satisfaction during the use IPTV services.

In order to minimize the effects of congestions on IPTV service, the IPTV traffic is marked with low delay and high priority CoS, so that IPTV services can run smoothly.

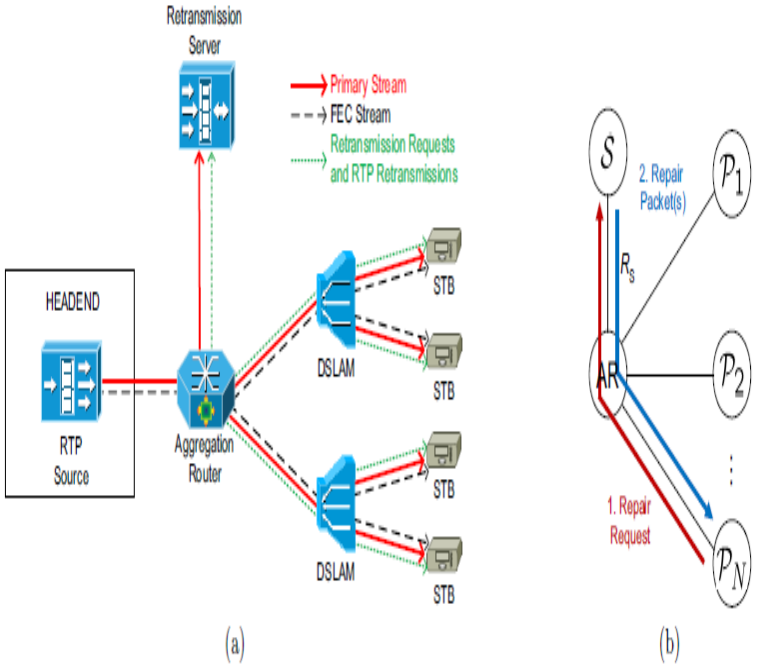
One solution to this problem is to join the multicast session directly instead of sending request through IGMP (Internet group management protocol) .Best approach given in online links [21] and [22].

In repairing packet we have to understand multicast nature and behavior because it have different variations and advancements .The discussion have been made in network and application layers of multicast define in several number of article and renowned approaches specially [23].

As mention in figure (1) [24] the loss packet retransmission server has been connected to aggregation router connected to access layer devices as DSLAM from which STB are connected at customer premises. IPTV Headend RTP source equipments is connected to aggregation router in network. Now the request travel from retransmission server to different node through aggregation router is move in the form of repair request .The topology move from these server and nodes are basically server-assisted repair scheme which help to repair the packet.

Now maintaining multicast in transmission nodes in which a large number of multicast groups are moved in scalable manner reviewed in [25].

Thus a lot of studies have been made in repairing packet loss in network for getting clear IPTV multicast stream. The key factor toward IPTV customer satisfaction is giving IPTV de-jittering, loss-repair and application level buffers to online IPTV customer.



(a) IPTV access network architecture with hybrid error control. IPTV primary and FEC stream are multicast to the IP STBs from the headend. Retransmission Server co-located with the aggregation router caches video streams and responds to retransmission request from the IP STBs. (b) The abstract network topology considered and the server-assisted repair scheme. Only the retransmissions are depicted.

Figure 1. Both diagrams show repair packet loss mechanism in access network [24]

2.5. Customer Satisfaction

IPTV customer satisfaction is directly related to controlled zapping time, repairing of packet loss, quality of services and quality of experience. By taking care of all such elements we can be able to satisfy IPTV customer by giving him guaranteed services. Once the existing customer satisfies it will have huge impact on new upcoming IPTV customers. It will defiantly increase the ratio IPTV customers.

Maintaining customer satisfaction is big challenge now a day different telecom companies want to implement new features in IPTV platforms. These features are TV shopping, Smart call , friend TV ,HDTV, TV gaming ,online audio song ,Information services, Online Photo album, Online Stock market rating, online Streaming, OTT (Over the top), transactional video on demand and personal video recording. Mention features are also available in IMS based IPTV. By implementing IMS based technology in IPTV platform we can be able to get efficient billing, application interface and session management functions [26].

Quality of services is integral part of IPTV customer satisfaction, which is better discuss in IPTV correlation model of QoS and QoE [27]. Main focus required on quality development function (QDF) better discussed in articles [28] and [29] .Its already better estimation of QoS with respect to IPTV customer satisfaction.

3. Proposed Model

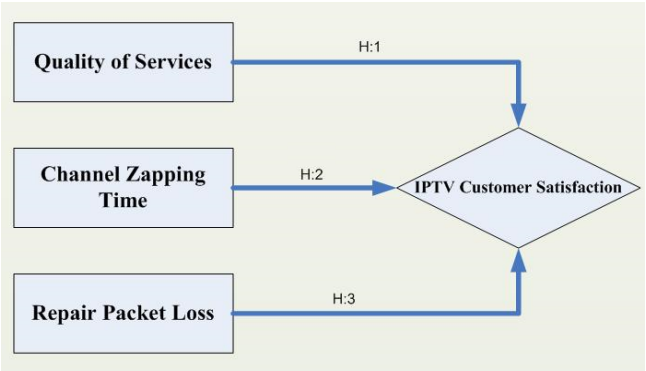


Figure 2. Proposed model diagram of showing correlation of IPTV Quality of Services, Channel Zapping Time, and Repair Packet Loss with respect to customer Satisfaction

4. Research Methodology

4.1. Primary data Research

Primary data collected by existing IPTV users through direct interview and telephonic conversation. Feedback received from user regarding Quality of services, channel zapping time and jitter / flickering / delay. During the interview positive response received from customer regarding improvement of quality of services. During the same conversation with IPTV user different type of more question were ask regarding channel zapping time delay and jitter / delay .Which has direct impact on customer

satisfaction during the use of IPTV services. Questioner of 170 respondents provides good help in this regards.

4.2. Hypothesis Testing

The research used the method of hypothesis testing method for checking and finding the results of our assumptions. After literature survey the hypothesis designed for each elements of the study. As shown in figure 2 .Correlations made between customer satisfactions with improvement of quality of services (H1). Channel Zapping Time delay with customer satisfaction (H2). Improving packet loss in network with IPTV customer satisfaction (H3). All correlations discussed further in analysis portion of paper and shown in proposed model figure 2.

4.3. Questionnaire Development

After literature survey and hypothesis development, questionnaires developed for carrying out of the research. We designed our own questionnaire with the help of several IPTV experts. Questions ask about improvement of quality of services which directly link to customer satisfaction. Channel Zapping Time delay and repair packet loss in network also discuss in Questionnaire development.

4.4. Survey from Customers

We conduct the questionnaire survey which geographically distributed all across Pakistan from specially IPTV experts and customers. We distributed 200 questionnaires copy to respondents, randomly selected from all the administrative units of Pakistan. One hundred and seventy were find enough good for analyzing.

5. Analysis

The data collected was analyzed in SPSS tools for finding out of results. First the authors check the reliability of some questionnaires and it was find good for further research. The following line shows the analysis of the data.

5.1. Reliability Test

Initially reliability test was done and the value of 7.8 Chron Bach's alpha was found for the reliability of the data.

5.2. Correlation Analysis

The following table shows the correlation analysis of the study.

Table 1. Showing analysis of correlation between Quality of services, Zapping Time and Repair Packet Loss with Customer satisfaction

		QoS	RPL	ZT	CS	Alpha
QoS	Pearson Correlation			1		.821
	Sig. (2-tailed)					
RPL	Pearson Correlation	.219(**)		1		.761
Sig. (2-tailed)				.100		
ZT	Pearson Correlation	.542(**)	.432(**)		1	.751
Sig. (2-tailed)		.130				
		.14				
CS	Pearson Correlation	.513(**)	.572(**)	-.672(**)	1	.824
Sig. (2-tailed)		.000	.000		.000	

H1: Quality of Services (QoS) has positive impact over Customer Satisfaction (CS)

The above table shows that QoS has positive and significant relationship with CS with the value of F-statistic 0.513 at the significance level 0.000. This shows that our assumption is correct which is about the impact of QoS on customer satisfaction in using IPTV service.

H2: Repair Packet Loss (RPL) has Positive impact over Customer Satisfaction (CS)

In above correlation table repair packet loss has positive significant relationship with customer satisfaction with F-statistic of 0.572 at the significant level 0.000. This shows our correct assumption of repair packet loss on customer satisfaction during IPTV services usage.

H3: Zapping Time (ZT) has negative impact over Customer Satisfaction (CS)

In above correlation table shows that zapping time has negative significant relationship with customer satisfaction with F-statistic of -0.672 at the significant level 0.000.This means that increase in zapping time will decrease customer satisfaction.

6. Conclusions

The research concluded that QoS, ZT and RPL have significant relationship and influence over IPTV CS. It was find out that QoS and RPL has positive and significant relationship with CS. This shows that increasing QoS and RPL will increase CS. Removing jitter and packet loss should be removed and minimized for CS of focus area. Decreasing zapping time between channels is key factor to customer satisfaction.

7. Recommendations

Basic recommendation of this paper is to present technology characteristics acceptance model for IPTV customer in regards of their satisfaction on running services. Below mention, points are our recommendation.

- QoS polices should implement on access network devices for smooth IPTV services.
- Quick technical response from IPTV operator is required on individual customer complaint. Trained technical staff is recommended for dealing IPTV related issues.
- IPTV Research and development room required in each telecom operator for understanding basic customer needs. For better understanding of faults and their rectifications.
- Understanding customer psychology by conducting customer related surveys and interviews.
- For getting better IPTV customer satisfaction IPTV Complaints Management System is important to be implemented.
- Preventive maintenance and dusting of IPTV equipment is recommended four times in a year in this regards.(to avoid different types outage in IPTV equipments).
- Implementing of new interactive features play great role in getting more and more IPTV customers. This directly relates to customer satisfaction.

8. Future Work

1. More research required in the field of improving QoS. IPTV operator should focus on its advancement and run its services and equipments accordingly.
2. Need is to find more tools and techniques in repairing packet loss in network.
3. More factors should be studied for improving Customer Satisfaction.
4. Further study of different mechanism and algorithm required to reduce zapping time between channels. Need more advancement in fast channel change.

REFERENCES

[1] Songbo, S. H. & Afifi, H. (2012). "Advanced IPTV Services Personalization through Context-Aware Content Recommendation," Multimedia, IEEE Transactions, 14 (6), pp.1528-1537

[2] Zeadally, S., Moustafa, H., & Siddiqui, F. (2011). "Internet Protocol Television (IPTV): Architecture, Trends, and Challenges," Systems Journal, IEEE, 5 (4), pp.518 – 527

[3] J. Kim, and Ki Hoon Lee, "Towards a theoretical framework of motivations and interactivity for using IPTV", Journal of Business Research, vol. 66, no. 2, pp. 260-264, Feb. 2013.

[4] ((Cisco , White paper)) [White paper: Cisco, "Evolving IPTV architecture", pp# USA]

[5] [(Braden, Zhang, Berson, Herzog, and Jamin ,1997)] [46] R. Braden, L. Zhang, S. Berson, S. Herzog, and S. Jamin, "RFC 2205: Resource ReSerVation Protocol (RSVP) – Version 1 Functional Specification," IETF, Tech. Rep., September 1997.Available: www.ietf.org/rfc/rfc2205.txt

[6] [(Zhu,David & Behzad)] [Liu Zhu, Gibbon David, Shahraray Behzad, "Uninterrupted Recording and Real Time Content based Indexing Service for IPTV Systems", AT&T Labs -Research200 South Laurel Avenue Middletown, NJ 07748 USA]

[7] Juniper Networks IPTV Security Solution: Integrated Security for Layered Protection, Juniper Networks,Sunnyvale, CA, White Paper 3510275-002-EN, Apr.2010]

[8] Zeadally Sherali, Moustafa Hassnaa and Siddiqui Farhan,"Internet Protocol Television (IPTV):Architecture, Trends, and Challenges", IEEE SYSTEMS JOURNAL, VOL.5,NO.4, pp.520-521, Dec 2011]

[9] [Riede C, Al-Hezmi A, Magedanz T (2008) Session and Media Signaling for IPTV via IMS.In: MOBILWARE '08: proceedings of the 1st international conference on MOBILe wireless MiddleWARE, operating systems, and applications, ICST (Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering), Innsbruck, Austria, pp 1–6]

[10] Sivasothy S, Lee GM, Crespi N (2009) A unified session control protocol for IPTV services. In:11th international conference on advanced communication technology, 2009. ICACT 2009. 11thinternational conference on, vol 02, pp 961–965]

[11] Sivasothy S, LeeGM, Crespi N (2009) DRAFT - SIP extensions for media control (Rev 5). IETF,draft-siva-sip-media-01 edn].

[12] Zeadally, S., Moustafa, H., & Siddiqui, F.(2011)."Internet Protocol Television (IPTV): Architecture, Trends, and Challenges," Systems Journal, IEEE, 5 (4), pp.518–527

[13] Maisonneuve, J.(2009)."An Overview of IPTV Standards Development," Broadcasting, IEEE Transactions, 55 (2), pp.315-328

[14] Smith, D. E., "IP TV Bandwidth Demand: Multicast and Channel Surfing," 26th IEEE International Conference on

Computer Communications, IEEE INFOCOM 2007, pp.2546-2550, May 2007.].

[15] Francisco Palacios,"IPTV TESTING OVER DSL http://documents.exfo.com/appnotes/anote148-ang.pdf

[16] Muhammad Zeeshan Ahmad, Nabil Ur Rehman, Junaid Qadir, Adeel Baig, Hammad Majeed,"Prediction-based Channel Zapping Latency Reduction Techniques for IPTV Systems - A Survey",2009 International Conference on Emerging Technologies, IEEE, Islamabad, December 11,2009, pp. 1-10

[17] C. Cho, I. Han, Y. Jun, and H. Lee, "Improvement of Channel Zapping Time in IPTV Services Using the Adjacent Groups Join-Leave Method," Advanced Communication Technology 2004, 2004,vol. 2, pp. 971–975.],

[18] F. Kozamernik & L. Vermaele, "Will Broadband TV shape the future of broadcasting?," EBU Technical Review, April 2005.

[19] S. Ooghe, "Guidelines for Video Service QoE Requirements," DSL Forum contribution, 2005.]

[20] R.E. Kooij, K. Ahmed, and K. Brunnstrom, "Perceived Quality of Channel Zapping,"ITU SG 12 Contribution, February 2006.],

[21] Internet Draft: draft-ietf-avt-rtcpssm-17, "RTCP extensions for single-source multicast sessions with unicast feedback." [Online]. Available: http://tools.ietf.org/html/ draft-ietf-avt-rtcpssm-17

[22] RFC 3376, "Internet group management protocol, version 3." [Online]. Available: http://www.ietf.org/rfc/rfc3376.txt

[23] V. Gopalakrishnan, B. Bhattacharjee,K. Ramakrishnan, R. Jana, and D.Srivastava. CPM:Adaptive video-on-demand with cooperative peer assists and multicast. In Proc. INFOCOM 2009, Rio de Janieiro, Brazil, April 2009.

[24] Zhi.L , Xiaoqing.Z , A.C.Begen and Bernd.G .Peer-Assisted Packet Loss Repair for IPTV Video Multicast. IEEE (2009)

[25] A. C. Begen, "Error control for IPTV over xDSL networks,"in IEEE Consumer Communications and Networking Conf.(CCNC), 2008.

[26] IXIA,"The challenges of IPTV delivery over IMS", 25 September 2007, available:http://www.ixiacom.com/library/white_papers/display?skey=ims_iptv

[27] H.long Kim & S.Gon Choi, "A Study on a QoS/QoE Correlation Model for QoE Evaluation on IPTV Service" Published in Avanced Communication technology (ICACT), Volume 2 ,2010

[28] Kwang-Jae Kim, Wan-Seon Shin, Dae-Kee Min, Hyun-Jin Kim, JinSung Y00, Hyun-Min Lim,Soo-Ha Lee, and Yong-Kee Jeong,"Analysis of key features in IPTV service quality model," IEEM2008,vol. I, pp.595-598, Dec. 2008.

[29] Kwang-Jae Kim, Wan-Seon Shin, Dae-Kee Min, Hyun-Jin Kim, Jin-~ung .Yoo, H~n-Min Lim, Sook-Ran Lee, and Yong-Kee Jeong,Service Quality Model for IPTV Service: Identification of Key Features and Their Relationship," INFORMS2008-Service Science 1. Washington D.C, Oct. 2008.