SERVICES AS PARAMETER TO PROVIDE BEST QOS : AN ANALYSIS OVER WIMAX

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Abstract

In this paper it is proposed to provide the QoS to the user by using the degradation of service under hostile environment being itself be a parameter to improve the QoS. Here the relation between the service and environment of its best performance drawn on the basis of simulation and analysis .The service then taken as a parameter to decide present environment of the user and to take measurable steps to improve the QoS either doing handover to nearby station or increasing power or to provide some marginal bandwidth etc.All analysis done over a WiMax network i.e. being designed and simulated using the Qualnet wireless simulator.

KEYWORDS
WiMax,Qualnet, USG, ertPS, rtPS, nrtPS, BE

1. INTRODUCTION

QoS means the offer versus delivery of a service. A quality of service framework is a fundamental component of a 4G broadband wireless network for satisfactory service delivery of evolving multimedia applications to end users, and managing the network resources.

In recent years, telecommunication operators are constantly seeking more efficient wireless broadband service, while telecommunication technology is continuously upgrading its access network technologies to cope with the high demands for high-speed internet access and multimedia service by end-users.

It is still a big challenge to maintain QoS providing AAA. Unlike wireless LANs, WiMAX networks incorporate several quality of service (QoS) mechanisms at the Media Access Control (MAC) level for guaranteed services for data, voice and video.The bandwidth is allocated to mission-critical, time-critical application without affecting any of the other applications or nodes in the network. WiMAX seems to be the solution as it is able to provide easy deployment, high speed data rate and wide range coverage. Most importantly, WiMAX provides Quality of Service (QoS) that can support all kinds of real-time application in wireless networks that includes priority scheduling and queuing for bandwidth allocation that is based on traffic scheduling algorithms within wireless networks. [3]

DOI : 10.5121/ijngn.2012.4103

After going through the Wimax QoS structure in section 2.The relation between the service and environment of its best performance being drawn on the basis of simulation and analysis in section 5.Finally its concluded that how the QoS can be provide to the user by using the degradation of service under hostile environment being itself be a parameter to improve the QoS.

2. WIMAX QOS STRUCTURE

The MAC layer of 802.16 (WiMAX) is designed to differentiate service among traffic categories with different multimedia requirements. The five data delivery service classes are

Unsolicited Grant Service (USG): UGS supports real-time service flows that generate a fixed-size data packet on a periodic basis, e.g., VoIP without silence suppression.

Extended Real-time Polling Service (ertPS): ertPS supports features of UGS with variable-size data packets, such as Voice over IP with silence suppression.

Real-Time Polling Service (rtPS): rtPS supports real-time service flows that generate variable-size data packets on a periodic basis, such as MPEG video or Voice over IP with silence suppression.

Non-real-time Polling Service (nrtPS): nrtPS supports delay-tolerant data streams consisting of variable-sized data packets for which a minimum data rate is required, such as FTP or HTTP (web browsing).

Best Effort (BE): BE service supports data streams for which no minimum service level is required and which may therefore be handled on a space-available basis. such as the transmission of HTTP[11]

Table 1. Comparison of WiMax QoS Classes [5]

QoS	Pros	Cons
UGS	No overhead. Meet guaranteed latency for real-time service	Bandwidth may not be utilized fully since allocations are granted regardless of current need.
ertPS	Optimal latency and data overhead efficiency	Need to use the polling mechanism (to meet the delay guarantee) and a mechanism to let the BS know when the traffic starts during the silent period.
rtPS	Optimal data transport efficiency	Require the overhead of bandwidth request and the polling latency (to meet the delay guarantee)
nrtPS	Provide efficient service for non-real-time traffic with minimum reserved rate	N/A
BE	Provide efficient service for BE traffic	No service guarantee; some connections may starve for long period of time.

3. ADVANTAGES OF QOS IN WIMAX

Low latency for mission-critical and mission-critical applications
Data prioritization (Bandwidth management)
Optimized transmission of multimedia applications .

4. RELATED WORK

For assuring best QoS i.e. to achieve ABC(always best connected),a lot of work has been done for the area such as

2006 : Claudio Cicconetti, Luciano Lenzini, and Enzo Mingozzi, Carl Eklund proposed that it is possible to employ scheduling algorithms that have been proposed for wired environments, which are able to provide QoS guarantees. In simulations, they have evaluated the deficit round robin(DRR) and weighted round robin (WRR)scheduling algorithms as possible candidates for algorithms to be implemented in a production system.[9]

2008 : HY Tung, KF Tsang, KT Ko verified that the QoS aware bandwidth allocation with threshold setting lowers the Blocking Probability of rtPS and nrtPS. [8]

2009 : Chakchai So-In, Raj Jain, and Abdel-Karim Tamimi classified recent scheduling disciplines based on the channel awareness in making the decision. Well-known scheduling discipline can be applied for each class such as EDF for rtPS and WFQ for nrtPS and WRR for inter-class. With the awareness of channel condition and with knowledge of applications, schedulers can maximize the system throughput or support more users.[5]

2011 : Rakesh Kumar Jha, Upena D Dalal, Suresh Limkar, Bholebawa Idris Zoherbhai in their networks model observed that there are a lot of factor involved i.e. distance between node (Fixed and Mobile) from BS altitude and LOS is different in different scenario with client with location with respect to BS. We also observed that QoS has effected with different Application (Here Voice over IP Telephony and MPEG).[3]

2012 : Here in this paper we proposed that as there is storng relationship between the envoirnm,ent and the Services,we can using services itself as an approach to improve QoS.

5. SIMULATION ENVIRONMENT

Qualnet, is a wireless network simulator in which using the IP protocols precedence field, applications can direct traffic to a specific service class. Table specifies the mapping between precedence values and service classes[13].This is the parameter being used to decide the service.

5.1. MAC layer Service Flow Mapping

Table 2. MAC Layer Service Flow Mapping

MAC Layer Services	Precedence
Unsolicited Grant Service	7,5
Extended real-time polling Service	4
Real-time polling Service	3
Non-Real-time polling Service	6,2,1
Best Effort	0

5.2. Simulation Configuration

Rest of the settings are

CHANNEL FREQUENCY : 2.4 GHz to 2.46 GHz
PROPAGATION MODEL : STATISTICAL
PROPAGATION LIMIT: -111.0 dBM
SHADOWING MODEL: CONSTANT
PATHLOSS MODEL : *
ENVOIRNMENT : *
PATHLOSS MODEL : *
FADING MODEL: *
SIMULATION TIME : 150 Sec
PHYSICAL TEMPERATURE: 290.0 K
PHYSICAL NOISE FACTOR : 10.0
ANTENNA MODEL : Omni Directional
ANTENNA GAIN : 12.0 DB
ANTENNA HEIGHT : 10.0 Meters

* Signifying The Parameters changed Each Time To Set Different Environments.

CBR : SOURCE: NODE 16 DESTINATION: NODE 15
INTERVAL: 0.2 SEC

5.3. Simulation Result and Description

Observation with accurate value

Table 3. Environment vs. Precedence(Accurate)

Environment /Precedence		Env 1	Env 2	Env 3	Env 4	Env 5	Env6	Env7
0	Throughput	166242	23704	35189	25998	10676	0	10286
	Delay	0.155312129	0.045536037	6.507874546	0.509012904	0.054538592	0	0.028184648
	Jitter	0.014306039	0.018228657	0.103889034	0.044179832	0.167555150	0	0.011589889
2	Throughput	150142	9584	36799	14305	7443	0	10423
	Delay	0.188677898	0.610726465	1.511074263	3.185379053	0.146059036	0	0.027801640
	Jitter	0.015109532	0.031249852	0.181527787	0.076557627	0.021802409	0	0.011870787
3	Throughput	142476	0	29197	9181	2349	0	3078
	Delay	4.109533089	0	2.276087619	0.474973108	1.775009781	0	o.457413434
	Jitter	0.022190664	0	0.198017515	0.019279418	0.488396558	0	0.025072371
4	Throughput	183989	0	34312	17792	31438	0	11803
	Delay	0.039104983	0	3.058o28446	0.027104184	M0.490616113	0	0.001820496
	Jitter	0.001623666	0	0.179544696	0.002763757	0.021913191	0	0.001820496
5	Throughput	183930	0	34312	14766	21088	0	11803
	Delay	0.050735121	0	3.058028446	0.044999229	0.093866524	0	0.457413434
	Jitter	0.001602932	0	0.179544696	0.006634014	0.027590741	0	0.001820496

Observation with range specification

Table 4. Environment vs. Precedence(Range)

Environment /Precedence		Env 1	Env 2	Env 3	Env 4	Env 5	Env 6	Env7
0	Throughput	UM	H	UM	H	M	L	H
	Delay	M	L	H	M	L	L	L
	Jitter	M	M	L	UM	M	L	L
2	Throughput	M	UM	H	LM	LM	L	UM
	Delay	M	L	L	H	M	L	L
	Jitter	M	H	M	H	L	L	M
3	Throughput	L	L (0)	L	L	L	L (0)	L
	Delay	H	L	M	M	H	L	L
	Jitter	H	L	H	M	H	L	H
4	Throughput	M	L	UM	UM	H	L	UM
	Delay	L	L	UM	L	M	L	L
	Jitter	L	L	M	L	L	L	L
5	Throughput	H	L	UM	M	UM	L	H
	Delay	L	L	UM	L	L	L	H
	Jitter	L	L	M	L	L	L	L

H: HIGH
UM: UPPER MEDIUM
M: MEDIUM
L: LOWER

5.4. Best Environment per Service

The best environment per service concluded from Table 3. and Table 4. is as follow

Table 5. Best Environment per Service

PRECEDENCE	SERVICE	ENVIORNMENT NO.
0	Best effort	7
2	Non-real-time Polling Service	3
3	Real-time Polling Service	4
4	Extended real-time Polling Service	4
5	Unsolicited Grant Service	1

6. MATLAB CONCLUDING PLOTS BASED ON OBSERVATION

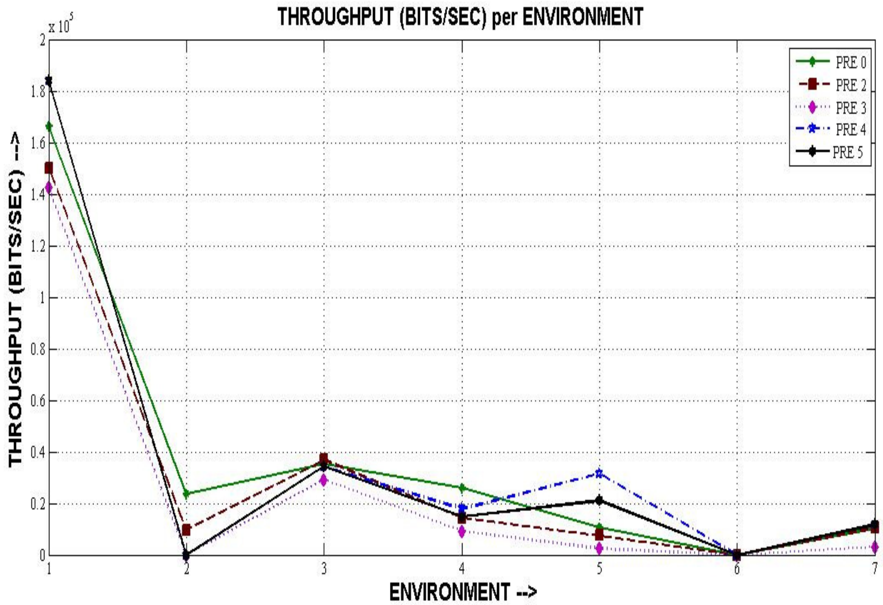

Figure 1. Throughput (Bits/Sec)

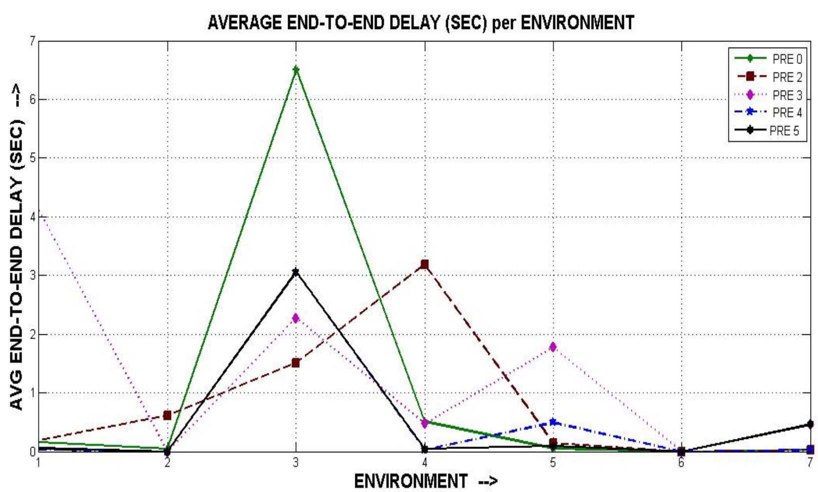

Figure 2. Average End-to-End Delay (Sec)

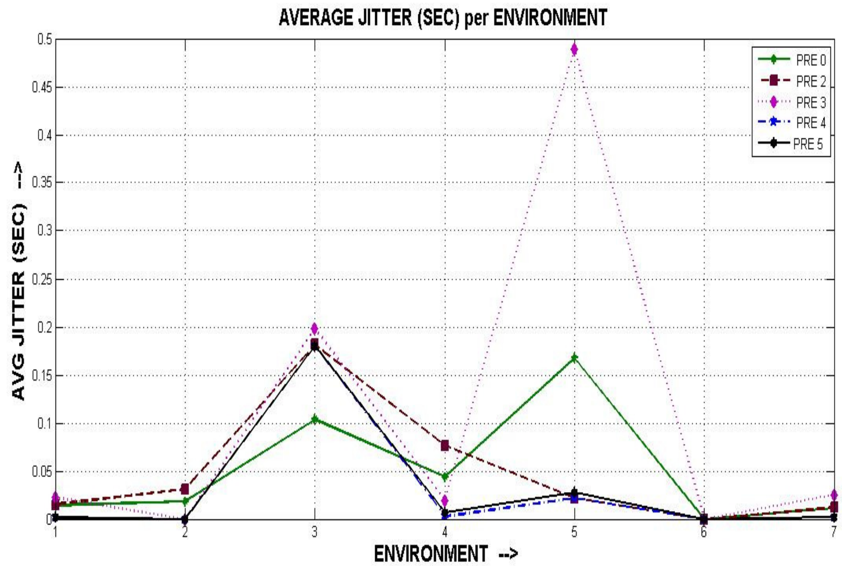

Figure 3. Average Jitter (Sec)

7. ANALYSIS

1.Best Effort service with precedence 0 provides best performance when the user switches from STREET M-to-M pathloss model to COST 231 HATA pathloss model.

2.Non-real-time Polling Service provides best performance when the user switches from TWO RAY pathloss model to semi urban area with STREET M-TO-M pathloss model.

3.Real-time Polling Service provide best performance when the user switches from semi urban area with STREET M-to-M pathloss model to OKUMARA HATA.

4.Extended real-time Polling Service provides best performance when the user switches from semi urban areas with STREET M-to-M pathloss model to OKUMARA HATA.

5.Unsolicited Grant Service provide best performance when the user switches from TWO RAY pathloss model to URBAN pathloss model

8. CONCLUSION

Due to fast development of technology, future communication and transmission are totally depends upon wireless network but quality of service (QoS) provision is a bigger challenge for wireless communications.

The design constraints at several layers of the IEEE 802.11 restrict its capacity to deliver guaranteed QoS. Recently due to its large coverage area, low cost of deployment and high speed data rates,WiMAX emerges as a promising technology for providing wireless last mile connectivity.

In this paper we are given concept of WiMAX (Worldwide Interoperability for Microwave Access) network performance for QoS monitoring and optimization solution as Physical and MAC layer of this technology which defines 5 different data delivery service classes that can be used in order to satisfy Quality of Service (QoS) requirements of different applications, such as VoIP, videoconference, FTP, Web, etc.

With aims to provide always the best quality of service (QoS) for users. Both the performance of applications and network conditions are considered and we observed that each service that is provided to the user does not work well in every environment. Different services have their best performance under different environment as listed and concluded above under analysis part. The QoS for the particular service will become poor as the user switch over to more hostile environment.Thus degradation in particular service will give information about the surrounding and proper measures can be taken to improve Qos at base station or by the service provider.

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