

Sudan University of Science & Technology
Collage of Post Graduate Studies
Faculty of Engineering & Technology
Department of Electronic Engineering

Quality of Service of Data in
Universal Mobile Telecommunication Systems

جودة خدمة البيانات فى النظم العالمية لأجهزة الإتصالات المحمولة

**A Thesis Submitted in Partial Fulfillment of the Requirements of the Degree of
M.SC. in Telecommunication Engineering.**

Prepared by: Salah eldeen Musa Elshaikh Abdelrahman

Supervisor: Dr.Ibrahim Khider Eltahir Khider

September 2011

DEDICATION:

To my parents I appreciated their efforts to me in my early days.
To all distinguished and helpful people I meet in my life I am honored to dedicate this
research.

Acknowledgment:

First of all, I would like to thank all the people who directly or indirectly have contributed to the publication of this research.

We are really proud of the whole colleagues that has allowed this challenge to become a reality despite the great workload, full of tight schedules, trips and weekends of work.

It has been a real pleasure to include the contribution from Dr.Ibrahim Kider Eltahir
Not forgetting the great help from Sudani for Telecommunication services Corporation, allowing the usage of its software and hardware and always providing us with its full technical support and expertise in anything we needed.

Finally, we would like to thank our families and friends for their patience and love.
We welcome any comment or question you may have related to this research in order to continue improving it. The e-mail address used for this purpose is:

Abstract:

The networks elements are composed of multiplicity of elements both for the core transport and the distribution networks.

To succeed today's competitive environment, telecommunication operators must focus on price, reliability, and quality of service these three elements are essential to provide customer satisfaction.

To meet the above requirement end-to-end quality of service is required.

Market requires real time and quality assured services .

It is going to be convergence of all IP networks and universal mobile telecommunication system radio access networks.

UMTS has been designed to support integrated service voice and data video those services can be divided into real time and non- real time.

Here we focus on the quality of services issues in IP/UMTS combined domain from end-to-end point of view.

□□□□□□□□:

تتكون شبكات الإتصالات من عناصر متعددة سواء بالنسبة لعناصر النقل الأساسية أو شبكات التوزيع. لكي يتحقق النجاح اليوم فى بيئة تنافسية، يجب على مشغلي الاتصالات توفير خدمات بسعر مناسب، وإعتمادية عالية وجودة.

هذه العناصر الثلاثة ضرورية لكسب رضا العملاء. لتحقيق ذلك تم الدمج بين نظام الإتصالات المحمولة العالمى و نظام الإنترنت فى شبكات الجيل الثالث.

وقد صمم نظام الإتصالات المحمولة العالمى لدعم الخدمات المتكاملة للصوت والصورة و البيانات تلك الخدمات يمكن تقسيمها إلى خدمات الوقت الحقيقي(مستمرة) ، وخدمات الوقت غير الحقيقي.

و فى هذا البحث تم التركيز على الخدمات التى تمزج بين نظام الإتصالات المحمولة العالمى و الإنترنت بروتوكول من نهاية إلى نهاية أى التى تحتاج إلى إستمرارية و جودة عالية.

contents:

Dedicationii

Acknowledgment.....iii

Abstractiv

contents.....vi

List of figures.....viii

List of tables.....viii

List of acronyms.....ix

Chapter one.....1

1.1 Introduction.....1

1.2 Thesis problem2

1.3 Thesis objective2

1.4 Assessment and methodology.....3

1.5 Thesis outlines.....3

Chapter two.....4

Background.....4

2.1 UMTS network Architecture4

2.1.1 UMTS radio interface.....5

2.1.2 Enhanced General packet radio service based services.....7

2.2 Internet Protocol traffic control on UMTS terminal equipment8

2.2.1	Shaping	9
2.2.2	Resource reservation protocol.....	10
2.2.3	Differentiated Services.....	13
2.2.4	Integrated Services.....	13
2.2.5	Network elements.....	13
2.3	Capabilities of Functional Elements.....	15
2.3.1	Gateway GPRS Support Node.....	15
2.3.2	Gateway GPRS Support Node features.....	18
2.3.3	Radio Network Controller.....	18
2.3.4	Serving general packet radio service Support Node.....	20
2.4	Packet data protocol context.....	20
2.4.1	Packet data protocol Management.....	22
2.4.2	Access Point Name.....	22
2.5	Quality of Service (QoS) aspects.....	27
2.5.1	QoS Metrics.....	27
2.5.2	Quality of Service Standardization.....	28
2.5.3	Quality of Service Requirements.....	30
2.6	Universal mobile telecommunication system Quality of Service.....	31
2.6.1	UMTS Quality of Service Architecture.....	31
2.6.2	UMTS quality of service Requirements.....	32
2.6.3	Quality of service and the Radio Interface.....	33
2.6.4	UMTS Quality of service classes.....	34
2.6.5	Universal mobile telecommunication systems traffic classes.....	36
2.5.6	End-to-end IP QoS in UMTS Network.....	37
2.6.7	Network controlled quality of service.....	39
2.6.8	Quality of service Provisioning Scenario.....	42
2.7	Service Experience.....	44
2.7.1	Service-Enhancing Technology.....	45

Chapter three Network Model.....	47
3.1 Hard ware components.....	47
Chapter Five Results and discussions.....	53
4.1 Results and discussions	53
Chapter Five Conclusion and recommendation.....	58
References.....	60
Appendix- A.....	61
Appendix-B.....	80
List of Figures:	
Figure 2.1: 3GPP UMTS architecture.....	6
Figure 2.2 IP Traffic Control on UMTS Terminal Equipment.....	9
Figure 2.3 IP QoS.....	12
Figure 2.4 GGSN interfaces.....	18
Figure 2.5 multiple PDP context.....	21
Figure 2.6 mapping between service bearer and different application servers via APN24	
Figure 2.7 APN application.....	26
Figure-2.8 3 GPP scope and IETF.....	28
Figure 2.9 quality of service management functions.....	29
Figure 2.10 QoS architecture.....	33
Figure 2.11 Service and QoS Provisioning Architecture.....	40
Figure 2.12 QoS Provisioning Scenario.....	43
Figure 3.1 UMTS and GSM packet switching network.....	47
Figure 4.1 GGSN GI max throughput vs. time.....	54
Figure 4.2 Figure 4.2 GGSN and SGSN GN max download/upload vs. time.....	54
Figure 4.3 KHC-W-RNC and KHN-W-RNC element Vs. DL PS throughput.....	55
Figure 4.4 KHC-W-RNC and KHN-W-RNC No.of Users Vs. time.....	56
Figure 4.5 packet switching service drop ratio vs. time.....	56
Figure 4.6 Sudani internet links utilization	57

List of Tables:

Tables 2.1 UMTS QoS classes.....	35
Table 2.2: IP bearer service Manager Capability in the UE and GGSN.....	38
Table 3.1 model network hardware components.....	47
Table 3.1 Real configuration parameters for QoS in KHC-GGSN.....	48
Table 3.2 KHC-SGSN QoS configuration parameters in SGSN.....	49
Table 3.3 3G SM Parameters table.....	50
Table 3.4 Parameters in RNC.....	50

LIST OF ACRONYMS

AAA Authentication and, authorization and accounting

ACL Access Control List

AMR Adaptive Multi Rate

APN Access Point Name

ATM Asynchronous Transfer Mode

AUC Authentication Unit

BER Bit Error Rate

BMC Broadcast Multicast control

BSS Base Station Subsystem

BTS Base Transceiver Station

CHAP Challenge-Handshake Authentication Protocol

CDMA Code Division Multiple Access

CN Core Network

COPS Common Open Policy Service protocol

DCA Dynamic Channel Allocation

DEC COPS Decision message

DiffServ Differentiated Services

DRQ COPS Delete Request state message

DSCP DiffServ Code Point

FACCH Fast Associated Control Channel

FD Frequency Division

FDD Frequency Division Duplex

GERAN GSM/EDGE Radio Access Network

GGSN Gateway GPRS Support Node

GMLC Gateway Mobile Location Center
GPRS General Packet Radio Service
GSM Global System Mobile
HLR Home Location Register
HTTP Hypertext Transfer Protocol
IETF INTERNET ENGINEERING TASK FORCE

IPSEC Internet protocol security
IMS IP Multimedia CN Subsystem
IMS IP Multimedia Subsystem
IMT International Mobile Telecommunications
IntServ Integrated Services
LAN Local Area Network
LDP Label Distribution Protocol
LTE Long Term Evolution
MAC Medium Access Control
MIMO Multiple Input and Multiple Output
MPLS Multiprotocol Label Switching Architecture
MSC Mobile Switching Center
MSE Mobile Switching element
MT Mobile terminal
MTS Mobile Telephone Service
MTX Mobile Telephone Exchange

NAT network address translation
OSI Open Systems Interconnection

PAP Password authentication protocol
PCF Packet Control Terminal

P-CSCF Proxy Call Session Control Function
PDCN Packet Data Serving Node

PDP Packet data Protocol
PDCP Packet Data Convergence Protocol
PDF Policy Decision Function
PDN Packet Data Network
PEP Policy Enforcement Point
PHB Per Hop Behavior
QoS Quality of Service
RAN Radio Access Network
REQ COPS Request message

RNC Radio Network Controller
RNC Radio Network Controller
RPT COPS Report state message
SBLP Service Based Local Policy
SDP Session Description Protocol
SGSN Serving GPRS support Node
SIP Session Initiation Protocol
SNMP Simple Network Management Protocol
SS Subscriber Station
TC Traffic Channel
TDMA Time Division Multiple Access
TE Terminal Equipment
TFT Traffic Flow Template
1G 1st Generation
UMTS Universal Mobile Telecommunication System
UTR UMTS terrestrial radio
WAP Wireless Application Protocol
WCDMA Wide Code Division Multiple Access

2G 2nd Generations

3G 3rd Generations

3GPP 3rd Generation Partnership Project

4G 4th Generations