

Abstract

Worldwide Interoperability for Microwave Access (WiMAX) is a broadband wireless technology based on IEEE 802.16-2004 and IEEE 802.16e-2005. This type of networks supports multiservice traffic (voice, video and Ftp) and guarantees the Quality of Service(QoS). This thesis evaluate the performance analysis of two routing protocols (AODV and OLSR) in WiMAX technology using voice as traffic. The background of WiMAX and routing protocol are introduced and analyzed. The performance of routing protocols is measured and compared according to the following criteria: delay, jitter, and throughput. Results for different scenarios–varied according to the number of users- are simulated using OPNET network simulator.

المستخلص

وايماكس هي تقنية لاسلكية ذات النطاق العريض تستند على المعيار IEEE 802.16-2004 والمعيار IEEE 802.16e-2005. هذا النوع من الشبكات يدعم عدد من الخدمات (الصوت والفيديو و FTP) ويضمن جودة الخدمة (QoS). هذه الأطروحة دراسة تحليله لأداء اثنين من بروتوكولات التوجيه (OLSR&AODV) في تكنولوجيا واي ماكس باستخدام نظام تطبيق الصوت. وقدمت خلفية عن الوايماكس وبروتوكولات التوجيه وتحليلها. تم قياس الأداء لبروتوكولات التوجيه AODV و OLSR وفقا للمعايير الآتية (delay, jitter, and throughput). ويشمل التحليل اختبار أداء البروتوكول في عدد مختلف من المستخدمين. وقد تم ذلك باستخدام برنامج محاكي الشبكات OPNET لتقييم أداء بروتوكولات التوجيه.

Acknowledgements

In the name of Allah, the Most Gracious and the Most Merciful Alhamdulillah. All praises to Allah for the strengths and His blessing in completing this thesis.

firstly To the spirit of my mother **Faiza Esmail Altahir**. Special appreciation goes to my supervisor, **Dr. Hassab Elgawi Osman** for supervising this thesis and for his kind support and valuable comments. I must express my deep gratitude to my family and my friends who have supported me and guided me to reached this stage.

Table of Contents

<i>Abstract</i>	I
المستخلص.....	II
<i>Acknowledgements</i>	III
<i>Table of Contents</i>	IV
<i>List of Figures</i>	VI
<i>List of Tables</i>	VII
<i>abbreviation</i>	VIII
chapter 1 introduction.....	1
1.1 introduction	1
1.2 Research Objectives	1
1.3 Research Methodology	1
1.4 Thesis Outlines	2
<i>Chapter 2 WiMAX Overview</i>	3
2.1 introduction.....	3
2.2 IEEE 802.16 Overview.....	3
2.3 WiMAX Feature.....	4
2.4 WiMAX Physical Layer	6
2.5 WiMAX MAC-Layer	7
2.5.1 Quality of Service.....	7
2.6 WiMAX Deployment	9
<i>Chapter 3 NetworksRouting Protocols</i>	11
3.1 Routing	11
3.2 Routing Types	11
3.3 Routing Protocols	12
3.4 Reactive Routing Protocols.....	13
3.4.1 Ad hoc On-demand Distance Vector (AODV).....	13
3.4.2 Dynamic Source Routing (DSR)	14
3.5 Proactive Routing Protocols	14
3.5.1 Optimized Link State (OLSR).....	14
<i>Chapter 4 Implementation and Results</i>	16
4.1 Implementation	16

4.2 Simulation Setting	16
4.2.1 Application Configuration.....	16
4.2.2 Profile Configuration	17
4.2.3 WiMAX Configuration	18
4.2.4 Base Station.....	18
4.3 Networks Performance Factors	19
4.3.1 Delay	20
4.3.2 Average Jitter.....	20
4.3.3 Throughput	20
4.3.4 Analyses According to Applications.....	20
4.3.5 Static Parameter for Simulation.....	20
4.4 Simulation Results.....	21
4.4.1 Simulation of First Scenario.....	21
4.4.2 Simulation of Second Scenario.....	22
4.4.3 Simulation of Third Scenario	31
4.4.4 Simulation of Four Scenario.....	32
4.5 Performance Analyses	23
4.6 Performance – First Scenario	27
4.7 Performance – Second Scenario.....	29
4.7 Performance – Third Scenario	31
4.7 Performance – Four Scenario.....	32
<i>Chapter 5 Conclusions and Future Works</i>	34
5.1 Conclusions.....	34
<i>Bibliography</i>	35

List of Figures

Fig 2.1 WiMAX Network Management Reference Model.	6
Fig 2.2 LOS and NLOS deployments.	9
Fig 2.3 PTMP and Mesh Modes.	10
Fig 3.1 MPR node sends the TC message.	15
Fig 4.1 Application configuration.	17
Fig 4.2 Profile Configuration.	17
Fig 4.3 WiMAX Configuration.	18
Fig 4.4 Base Station Configuration.	19
Fig 4.5 Simulating 10 nodes.	23
Fig 4.6 Simulating 20 nodes.	24
Fig 4.7 Simulating 40 nodes.	25
Fig 4.8 Simulating 60 nodes.	26
Fig 4.9 Delay for AODV and OLSR using 10 Mobile Nodes.	27
Fig 4.10 Jitter for AODV and OLSR using 10 Mobile Nodes.	28
Fig 4.11 Throughput for AODV and OLSR using 10 Mobile Nodes.	28
Fig 4.12 Delay for AODV and OLSR using 20 Mobile Nodes.	29
Fig 4.13 Jitter for AODV and OLSR using 20 Mobile Nodes.	30
Fig 4.14 Throughput for AODV and OLSR using 20 Mobile Nodes.	30
Fig 4.15 Delay for AODV and OLSR using 40 Mobile Nodes.	31
Fig 4.16 Jitter for AODV and OLSR using 40 Mobile Nodes.	31
Fig 4.17 Throughput for AODV and OLSR using 40 Mobile Nodes.	32
Fig 4.18 Delay for AODV and OLSR using 60 Mobile Nodes.	32
Fig 4.19 Jitter for AODV and OLSR using 60 Mobile Nodes.	33
Fig 4.20 Throughput for AODV and OLSR using 60 Mobile Nodes.	33

List of Tables

Table 2.1 shows the QoS parameters defined for each service type and the application examples.....	8
Table 4.1 Static Parameter for simulation.	20

Abbreviation

Abbreviation	Name
WiMAX	Worldwide Interoperability for Microwave Access
OFDM	Orthogonal Frequency Division Multiplexing
MAN	metropolitan area network
IEEE	Institute of Electrical and Electronics Engineers
BWA	Broadband Wireless Access
AES	Advanced Encryption Standard
EAP	Extensible Authentication Protocol
TDD	time division duplexing
FDD	frequency division duplexing
ARQ	automatic retransmission requests
AMC	Adaptive modulation and coding
NLOS	non-line-of-sight
MIB	Management Information Base
DL	Down-link
UL	Up-link
SDU	service data units
MPDU	MAC protocol data units
DOCSIS	Data over Cable Service Interface Specification
BS	Base Station
UGS	Unsolicited grant services
RTPS	Real time polling service
NRTPS	Non real time polling service
BE	Best effort
ERTPS	Extended real-time polling rate service
SFID	service flow identifier

QoS	Quality of services
MS	Mobile station
NLoS	Non-Line-of-Sight
LOS	Line-of-Sight service
PMP	point-to multipoint
RSs	relay stations
AODV	Ad hoc On-demand Distance Vector
DSN	Destination Sequence Numbers
RREQs	Route Request
RREPs	Route Replies
RERRs	Route Errors
UDP	user datagram protocol
TTL	Time-To-Live
DSR	Dynamic Source Routing
OLSR	Optimized Link State Routing
MPR	Multipoint relay
BS	Base station